1. Proposed Research Program

SCIENTIFIC TRADITIONS IN ISLAMIC SOCIETIES (STIS): INTELLECTUAL, INSTITUTIONAL, RELIGIOUS, AND SOCIAL CONTEXTS

This research program aims to transform the conventional view of pre-1800 Islamic intellectual history by providing concrete and verifiable evidence that a non-religious cosmology was integrated into the worldview of a substantial number of Muslim intellectuals and educated laypeople, and that this worldview found a place within both religious and secular institutions. It also aims to challenge our understanding of early modern European science by showing that a number of its salient features usually taken to prove European exceptionalism had, in fact, Islamic roots. To accomplish these goals, the program focuses on three main research themes: 1) the development of a secular, scientific cosmology that became integral to Islamic societies; 2) the transformation of Hellenistic astronomy within Islam that laid the foundation for modern science; and 3) the evolution of the relationship between an independent science and Abrahamic revelation that is one of the cornerstones of modernism. The methodology will consist of the careful examination of previously unstudied but nevertheless key works in Islamic scientific cosmology and the use of an innovative, sophisticated database that will map the intellectual, institutional, religious, and social contexts of this tradition. This project and its database will provide the model and methodological basis for a larger international collaboration of the leading researchers and institutions in all fields of Islamic science.

Introduction and Background

Islamic civilization in the 8th and 9th centuries appropriated, by means of translations, oral transmission, and acts of reconstruction and rediscovery, a large part of the ancient Hellenistic philosophical, scientific, and mathematical legacy. This stands as one of the truly remarkable intellectual achievements in human history. Although this transmission of knowledge is generally acknowledged in most histories of Islam, the meaning and long term consequences of this event have been hotly debated for some time. Recently a number of works have attempted to contextualize the Hellenistic tradition within Islam. Several have argued that this tradition should be considered an integral part of Islamic intellectual history;[1] others have held that the ancient scientific tradition remained "foreign" to Islam and was at best a marginal phenomenon.[2]

This research will mark an innovative way to deal with these issues by examining a particular type of Islamic astronomical literature that put forth a cosmology, a picture of the entire physical universe, deriving from ancient Greek astronomy. Since there is also in Islam a religious cosmology based upon the Qur'an and *hadith* (sayings and traditions of the Prophet), these co-existing, and potentially competing, cosmologies offer us a case study of the interaction of science and religion within an Islamic context. A survey of scientific cosmology in Islam also gives us an opportunity to accumulate data on the extent to which Hellenism spread into and penetrated Islamic intellectual life. This is a fundamental part of the larger inquiry into the rational traditions of secular (i.e. non-religious) knowledge within Islamic societies and the possibilities for their development and sustainability. And because of its proven links to early modern European astronomy, this scientific cosmology provides a means to explore transcultural

[1] For example, "The Appropriation and Subsequent Naturalization of Greek Science in Medieval Islam: A Preliminary Statement," *History of Science* 25 (1987): 223-243, and the papers addressing this article in F.J. Ragep and S.P. Ragep (eds.), *Tradition, Transmission, Transformation: Proceedings of Two Conferences on Premodern Science Held at the University of Oklahoma* (Leiden: E.J. Brill, 1996). F. Rosenthal makes a similar case in his *The Classical Heritage in Islam* (Berkeley: University of California Press, 1975).

[2] See T. Huff, *The Rise of Early Modern Science: Islam, China, and the West* (Cambridge: Cambridge University Press, 1993) for a recent statement by a sociologist of this position. Though arguing from a totally different perspective (that of a scientist from a Muslim country), P. Hoodbhoy maintains a similar viewpoint in his *Islam and Science* (London: Zed Books, 1991).

transmission of both technical knowledge and philosophies of science inherent in mathematical cosmologies. In the latter case, this will allow us to examine critically the role Islamic science played in the rise of what is generally called modern European science.

From a methodological standpoint, most attempts to deal with these questions have been fairly limited in scope since only a small percentage (probably less than 5%) of the 25,000 or more scientific manuscripts have been examined. For scientific cosmology, only a handful of the approximately 500 titles have been edited, translated, or examined in recent times. By treating this literature in a holistic way using innovative tools, it will be possible for the first time to trace its sources and subsequent influences, and to understand the role it played on the intellectual, institutional, religious, and social levels.

Research Themes

The history of astronomy offers unique insights into cultural and intellectual history. It was the first science to be mathematicized (because of the regularity of celestial motions) and thus provides important perspectives on the relationship between natural philosophy and mathematics. Because of its connections with cosmology in general, and with the created universe of the Abrahamic religions in particular, the history of astronomy is also an important entrée into the science-religion conundrum. My research deals with both the technical aspects of the history of astronomy and with its cultural significance. These are reflected in my three research themes.

1. *The Development of a Secular, Scientific Cosmology That Became Integral to Islamic Societies*

Scientific cosmology (in Arabic: *hay'a*) arose at a fairly early date in the history of science in Islam (perhaps as early as the eighth century). Generally speaking, it was based upon the complicated mathematical models found in the *Almagest* of the Alexandrian astronomer Claudius Ptolemy (2^{nd} CE). This cosmology was Earth-centered with a variety of solid, spherical bodies, embedded one inside the other, forming a spherical celestial region inside of which was the spherical Earth and its atmosphere.

This was the cosmology of the Islamic scientists, and one might assume that it would remain within their domain given that the Qur`an and *hadith* provided a religious cosmogony and cosmology for non-scientists. However, from the manuscript evidence, religious writings, and encyclopedic literature, it appears that it was *hay'a*, the scientific cosmology, that became predominant in several Islamic societies—in both secular and religious contexts—especially after the twelfth century CE and continuing until the late nineteenth century.

This is striking considering the wide-spread religious denunciations of astrology (often popularly associated with Hellenistic cosmology) and Aristotelian physics and metaphysics upon which *hay'a* was generally taken to be based. Nevertheless, one finds thousands of copies of *hay'a* texts in manuscript libraries throughout the Islamic world that attest to the widespread acceptance and teaching of this secular cosmology. One key teaching text, Jaghmini's *al-Mulakhkhas fi `ilm al-hay'a* (13^{th} CE), was the subject of no fewer than 25 commentaries. There are today over 100 manuscript copies of one fifteenth-century commentary in Istanbul alone. And Jaghmini's work was only one of several dozen elementary astronomy texts produced in premodern Islam. This indicates a thriving school tradition that continued over many centuries. But which schools? Contrary to most secondary literature, there is mounting evidence, uncovered by myself and other researchers, indicating that these works were studied in the religious schools (*madrasa*s). This is reinforced by the amount of astronomical information contained in a variety of theological and legal textbooks taught in the *madrasa*s.

Key Research Questions:

1) How widespread was the teaching of astronomy in the *madrasa*s? When did the teaching of secular subjects in *madrasa*s begin and end? Who were the teachers and was this teaching part of a set curriculum or was it done on an ad hoc basis?

2) Was there an attempt to reconcile the scientific cosmology contained in these textbooks with the religious cosmology of the Qur'an and other religious teachings?
3) What were their motivations for engaging in the study? We know of practical reasons this work could be useful (astrology, map-making, religious ritual such as prayer times) but much of the advanced work did not have practical value. Can we detect a desire to understand God's creation (such as is apparent in the early modern work of Kepler and Newton) and/or a desire for knowledge for its own sake as was the ideal of the Greek philosophers?

Methodology:
For Research Question 1, I will use a sophisticated relational database, under development, that will allow us to catalogue *hay'a* works and provide for the first time the means to establish the social, institutional, and intellectual contexts in which these works were produced, taught, and studied. This will permit us to document the extent to which a scientific cosmology (as distinct from a religious one) became rooted within premodern Islamic societies. Examining notes on title pages and marginalia of thousands of manuscripts will provide evidence for the institutional context in which these texts were taught and studied.

For Research Questions 2 and 3, I will study key texts in the *hay'a* tradition (to see what astronomers themselves say about the relation of their cosmology to religious scripture and their motivations) as well as in religious literature, in particular theological texts, Qur'anic commentaries, and legal texts. This research represents a new departure from recent work[3] in that it will examine a far larger corpus of scientific, philosophical, and religious literature with the aim of understanding the means by which a scientific cosmology came to be accepted and institutionalized within Islamic societies. Motivations will be determined not only from the statements of individual authors (which often are simply formulaic) but also by analyzing competing views regarding the value of a scientific approach to cosmology. The Scientific Traditions in Islamic Societies (STIS) database will be indispensable for identifying key *hay'a* works (based upon dissemination and their documented influence); for religious texts, especially *kalam* works, I will consult with my colleague Robert Wisnovsky, who has compiled a list of key texts.

2. *Transformations of Hellenistic Astronomy in Islam: Laying Foundations for Modern Science*

In the mid-1950s, E.S. Kennedy, with help from Otto Neugebauer, made the astonishing discovery that Copernicus's astronomical models were identical to those of late medieval Islamic astronomers. Since that time, additional connections between Islamic astronomers and Copernicus (as well as other early modern European scientists) have come to light. At first this was treated as a technical matter and one that could indicate parallelism rather than influence. In the last ten years, though, I have presented evidence that Copernicus was indebted to his Islamic predecessors for theories about the possible rotation of the Earth as well as a proposition allowing for the transformation from a geocentric to heliocentric cosmology, ideas and theories that clearly go beyond purely technical considerations.[4]

It is now clear that the genre of *hay'a* was an important factor that allowed for the proposal of these alternative models and theories. Though the roots of *hay'a* are in antiquity, Islamic astronomers and philosophers were dissatisfied with inconsistencies between the underlying Aristotelian physical principles and the actual astronomical models developed in Hellenistic Greece, especially those of Ptolemy. This led them to put forth alternative models within the *hay'a* genre, which, being mathematical

[3] F. Jamil Ragep, "Freeing Astronomy from Philosophy: An Aspect of Islamic Influence on Science," *Osiris* 16 (2001): 49-71; A. I. Sabra, "Science and Philosophy in Medieval Islamic Theology," *Zeitschrift für Geschichte der Arabisch-Islamischen Wissenschaften* 9 (1994): 1-42; Ahmad Dallal, "Science and the Qur'an," *Encyclopaedia of the Qur'an*, ed. Jane McAuliffe (Leiden: E. J. Brill, 2004); and Robert Morrison, *Religion and Science in Medieval Iran* (Routledge, forthcoming).
[4] A survey and analysis of the literature can be found in F. Jamil Ragep, "Copernicus and His Islamic Predecessors: Some Historical Remarks," *Filozofski vestnik* 25/2 (2004): 125–142. (To be reprinted with an update in *Journal for the History of Astronomy*, February 2007).

cosmology, provided a framework for resolving these discrepancies. Related to this challenge to ancient authority is the considerable effort expended by Islamic astronomers in testing Greek and Indian parameters, often found lacking in precision, and replacing them on the basis of new observations.

Dozens of *hay'a* works exist dealing with these complex questions and were meant for more serious astronomers. Though some were composed in the context of court or other patronage, others seem to have been written in the context of scholarly traditions, a conclusion reinforced by the large number of extant manuscript copies of these more advanced *hay'a* works. In some cases one can trace research traditions that went on for five or more centuries. Such a tradition was begun by Nasir al-Din al-Tusi (13th century), one of the most important astronomers of the entire Islamic Middle Ages. His *Memoir on Astronomy*, which I have edited and translated, was subject to no fewer than fifteen commentaries and influenced dozens of other works well into the nineteenth century, including Copernicus's *De revolutionibus*.[5]

Key Research Questions:

1) Why did theoretical astronomy in Islam diverge so decisively from its Greek predecessors? Were there social, cultural, and/or religious factors at work that led to a greater demand in Islam for a more consistent astronomy?
2) How did cosmological questions, such as the Earth's rotation, come to be seen as an astronomical, as opposed to a philosophical, question?
3) How were astronomers at the advanced level supported in Islam? How were they trained?
4) What were the transmission pathways by which Copernicus and other early modern astronomers learned of this Islamic astronomy, most of which was not translated from Arabic and Persian?
5) Is there a way to relate this Islamic challenge to Greek science and philosophy to the similar challenge that occurred during the scientific revolution? In other words, is this European scientific basis of modernism *sui generis* or does it owe a substantial debt to Islamic science?

Methodology:

Research Questions 1 and 2 require close readings of texts and analyses of scientific content. I am currently leading a team that is editing and translating the extant Greek, Arabic and Hebrew texts of Ptolemy's *Planetary Hypotheses*, which is one of the few major Greek scientific works left unedited. As well as supplying unique information about Hellenistic and earlier Greek astronomy, philosophy, and cosmology, an edition of the *Planetary Hypotheses* will be invaluable in analyzing the Islamic reception of Hellenistic astronomy, since it is the key text against which many Islamic astronomers reacted. Ptolemy's views regarding the Earth's stasis also provides the background for understanding the ongoing debate in Islamic astronomy about how to determine this crucial aspect of cosmology. Again my methodology will be to collect materials that were written over a long span (from ca. 1250-1600) that indicate a long, continuous, and interactive discourse that will help us understand the process by which the motion of the Earth came to be accepted and dispel the notion that this was the work of a single genius.[6] Another way to deal with these issues is by studying the astronomical works of someone usually considered more of a philosopher than scientist, i.e. the great philosopher Ibn Sina (Avicenna, died 1037). His discussions, and those of members of his circle, regarding precision, the motion of the Earth, and so forth provide invaluable insight into the divergences between Islamic and Hellenistic philosophies of science.[7] This research will also provide an important intersection point with the work of Wisnovsky, one

[5] F. Jamil Ragep, *Nasir al-Din al-Tusi's Memoir on Astronomy (al-Tadhkira fi `ilm al-hay'a),* edition, translation, commentary and introduction, 2 vols. (New York: Springer-Verlag, 1993).

[6] For my preliminary work on this question, see "Tusi and Copernicus: The Earth's Motion in Context," *Science in Context* 14, nos. 1-2 (2001): 145-163.

[7] A survey of Avicenna's astronomical works is in: F. Jamil Ragep and Sally P. Ragep, "The Astronomical and Cosmological Works of Ibn Sina: Some Preliminary Remarks," in *Sciences, techniques et instruments dans le monde iranien (Xe–XIXe siècle),* études réunies et présentées par N. Pourjavady et Ž. Vesel (Tehran, 2004), pp. 3–15.

of the foremost authorities on the philosophy of Ibn Sina, and will make McGill one of the few places in the world where one can begin to answer such questions.

Research Question 3 requires both close reading of texts and the STIS database, which will allow us for the first time to collect and retrieve data on the training of astronomers, their patrons, teaching, research circles, and students. One key text giving us a unique perspective on patronage is Tusi's Persian *hay'a* works that he wrote while at an Isma`ili court in Iran. I am editing and translating this work in collaboration with S. Ragep (McGill) and Prof. W. Thackston (Harvard).

Research Questions 4 and 5, because of the necessary range of skills and languages, requires a multidisciplinary group from Islamic and European studies. Because of my extensive work on the influence of Islamic astronomy on Copernicus, I have been able to organize such a group that will meet several times between 2006 and 2008 in Berlin at the Max Planck Institute for the History of Science, with the aim of writing a book on the multicultural context of the Copernican revolution.

3. *The Evolution of the Relationship between an Independent Science and Abrahamic Revelation: A Cornerstone of Modernism*

It is remarkable that a number of Islamic astronomers questioned the need for Aristotelian physical principles as a basis for astronomy. In my article "Freeing Astronomy from Philosophy" (*Osiris*, 2001), I argued that these Islamic astronomers were influenced by the theologians, who looked askance at some aspects of Aristotelian natural philosophy. But in addition, some theologians (some of whom also wore the hat of science) were also influenced by the scientists to such a degree that scientific matters were often discussed and debated in religious texts. One of the outcomes of these interactions was the attempt to make astronomy (and other mathematical sciences) independent of philosophy and theology, which, unlike mathematics, were held by some to be based upon contested and unprovable principles. This point was strongly argued for by the fifteenth-century Central Asian theologian/astronomer `Ali Qushji. It is striking that he also suggested that the Earth might be rotating and furthermore set forth a mathematical proposition later used by Copernicus to establish his heliocentric cosmology.[8]

Key Research Questions:

1) Were there tensions between those who wanted an independent science and those who insisted upon the unity of "Islamic knowledge"?
2) Did these Islamic attempts to establish a metaphysically-free astronomy independent of philosophy and religion influence early modern European astronomy?
3) Why did this "modern" tendency not develop into modern (i.e. European-like) science in the Islamic world?

Methodology:

To address these three questions, one needs much more evidence about the role of science in religious books and institutions. The STIS database provides a means to gather and process such data. By combining those results with data from the Professor Wisnovsky's work on post-classical Islamic philosophy here at McGill, we will be able to test how extensively scientific material entered into the theological literature and the types of interactions that occurred. The other way in which to pursue this research is to study major religious texts in which scientific matters were being debated. Following upon my research into the astronomical and theological writings of `Ali Qushji (15th CE in Samarqand and Istanbul), I have begun a collaborative project with colleagues in Turkey to study the thought of this creative thinker who challenged both orthodox religious and philosophical thinking. The working group I

[8] See F. Jamil Ragep, "`Ali Qushji and Regiomontanus: Eccentric Transformations and Copernican Revolutions," *Journal for the History of Astronomy* 36/4 (2005): 359-371.

have organized in Berlin to study the context of the Copernican Revolution (mentioned in Theme 2) will also provide opportunities to deal with these questions.

Projected Research Outcomes

- A monograph on Islamic theoretical astronomy based upon studies of individual texts and the STIS database. Written in an accessible style for specialists in history of science, Islamic studies, medieval and early modern studies, cultural studies, and general history, it will allow this important aspect of Islamic Civilization to be incorporated in future secondary work discussing Islam and science.
- A book on the Islamic role in the scientific revolution. This will be part of a collaborative effort between researchers at McGill and the Max Planck Institute for the History of Science in Berlin to produce a series of works on the Islamic roots of European modernism.
- An edition of the works of `Ali Qushji, one of the most innovative philosophers/theologians/ scientists in Islamic intellectual history. I have begun this project with colleagues in Turkey, and plan to expand the collaboration with colleagues in other countries.
- An undergraduate textbook on the history of science in Islamic societies that incorporates my research on Islamic scientific cosmology. This will be based on my 15-plus years of experience teaching "Science and Civilization in Islam" at the University of Oklahoma and McGill.
- The STIS database that will serve as a model on both the analytical and methodological levels for a project to catalogue, survey, and analyze all works in the Islamic exact sciences. This project, the Islamic Scientific Manuscripts Initiative (ISMI), has already been instituted under my directorship as an international collaborative endeavor of the top researchers and institutions in the field. It will make available online an unprecedented amount of data on Islamic science for use by scholars and the general public who wish to understand this important legacy of Islamic civilization.

2. Research Training and Supervision

This program will attract top caliber students and postdoctoral researchers from Canada, North America, Europe, and the Islamic world because of the innovative nature of the program and the opportunities it will provide. McGill is one of a handful of institutions worldwide offering advanced graduate studies in the history of science in Islamic societies, and it is virtually unique in doing so within the framework of a world-renowned institute devoted to Islamic studies. Thus students will learn both the technical scientific and linguistic skills needed to pursue research while also receiving instruction in the social, religious, and historical contexts in which science was pursued in Islamic societies. Because medieval scientific Arabic and Persian, as well as the scientific concepts involved, are historically distinct and are no longer generally studied, students, including those with native language abilities, need to be trained intensively in order to read, understand, and eventually edit and translate Islamic scientific manuscripts. I will thus work closely with students at the master's and doctoral levels on these skills. In conjunction with my colleagues at the Institute, students will be taught complementary aspects of Islamic intellectual history, such as philosophy, theology, and law, all areas of relevance to science, as well as Islamic paleography and codicology. Furthermore, graduate students will have unique opportunities, through my extensive network of contacts and advisory board memberships, to travel to manuscript collections worldwide, participate in international conferences, learn how to submit articles for peer-reviewed publications, and collaborate with world-renowned scholars and student peers.

Through my undergraduate courses, I will encourage qualified students to pursue advanced studies in the field. I also will encourage postdoctoral researchers to come to McGill for additional training and collaboration. Students and researchers at all levels (undergraduate, graduate, and postdoctoral) will have the exciting and unique opportunity to handle manuscript material that has not been examined in modern times. They will also have the chance to learn the advanced methodological tools associated with the STIS database, which will have applications for other areas of the humanities and social sciences.

Integration with the Strategic Research Plan

Institutional Environment

McGill's Institute of Islamic Studies is the planned institutional environment for the proposed Canada Research Chair in the History of Science in Islamic Societies, and the proposed Chair's research program, entitled "Scientific Traditions in Islamic Societies (STIS)" fits precisely within a current primary research focus within the Institute. The successful recruitment of Professor Jamil Ragep, when combined with the proposed chair, will make the Institute of Islamic Studies one of the leading departments in North America, if not the pre-eminent department, in which to study Islamic intellectual history. Islamic law and jurisprudence, represented by Professor Wael Hallaq, and Islamic philosophy and theology, represented by Professor Robert Wisnovsky, would be perfectly complemented by Professor Ragep's expertise in the exact sciences in Islam. Collaboration with Professor Wisnovsky, in particular, will be an important element in STIS, given the intricate and extensive connections between his research interests and those of Professor Ragep.

The Chair in the History of Science in Islamic Societies and the Scientific Traditions in Islamic Societies Research Program will be physically situated in three rooms in the ground floor of Morrice Hall, home to the Institute of Islamic Studies and the Islamic Studies Library. This will enable the Chair and researchers associated with the STIS Program to take full advantage of the bibliographic resources available in the Islamic Studies Library, which contains a world-class collection of Islamic materials, including reference and bibliographic materials that are necessary for the successful completion of the research program. What is more, Adam Gacek, the Head of the Islamic Studies Library, is a world-renowned scholar of Arabic paleography and codicology, and his expertise in these two fields will be of crucial assistance to the Chair and STIS researchers.

In general, the proposed Chair and STIS research program will build upon the Institute of Islamic Studies' tradition of scholarly excellence in the study of pre-modern Islamic civilization. Professor Ragep's arrival helps to solidify the Institute's reputation for training graduate students in the linguistic and text-reading skills that are needed to satisfy the growing demand for historically grounded scholarship in the field of Islamic Studies.

Beyond the Institute of Islamic Studies, the proposed Chair and STIS research program will be well integrated into McGill's Faculty of Arts. The past year has seen the crystallization of a small but growing McGill research team devoted to medieval European, Jewish and Islamic intellectual history, entitled "Translation, transmission and transformation in medieval cultures"; this team has recently been awarded funding by the FQRSC's "Équipe en émergence" program as well as by SSHRC's "Aid to Workshops" program. Team members include Professors Wisnovsky, Faith Wallis (History), Carlos Fraenkel (Jewish Studies/Philosophy) and Jamie Fumo (English). The proposed Chair's research focus will nicely complement the work of this group. McGill's Program in the History and Philosophy of Science has also enjoyed something of a renaissance in recent years, sparked in part by the arrival of several new junior faculty members, Professors James Delbourgo and Nicholas Dew (both of History). Again, the award of the proposed chair to Professor Ragep, who until coming to McGill chaired the History of Science Department at the University of Oklahoma – one of the most prestigious such programs in North America – can only help to solidify this exciting development. Professor Ragep's experience in teaching all aspects of Islamic science and medicine will also benefit the new Arts Legacy program, in which Islamic Studies currently enjoys an already strong presence, and he will serve as a conversation partner with Social Studies of Medicine colleagues who are interested in exploring the history of medicine in Islam. Outside the Faculty of Arts, Professor Ragep will also be able to create links with Faculty of Science colleagues, particularly those in the Departments of Physics and Mathematics who are interested in exploring the pre-modern history of their disciplines.

Internationally, the proposed Chair and STIS research program will increase the opportunity for collaboration with major research centers and institutes involved in the study of the history of science and Islamic intellectual history. Professor Ragep already heads a research team at the Max Planck Institute for the History of Science, in Berlin, and in partnership with that Institute is developing a large-scale relational database of Arabic scientific manuscripts. Through that database-development partnership with the Max Planck Institute, Professor Ragep is also collaborating with archives, departments and institutes throughout Europe, the Middle East, and South and East Asia. Links with these academic units will bring concrete benefits to McGill scholars and students, who will be able to build upon and utilize the proposed Chair's academic relationships to achieve their own scholarly goals.

Institutional Commitment

McGill's commitment to the Canada Research Chair in the History of Science in Islamic Societies is evident in the support that the university has recently given to the Institute of Islamic Studies, resulting in the doubling in size of the Institute's faculty (see below), as well as in the provision of infrastructure support to be given to the proposed Chair. As with the social and "hard" sciences, some of the most cutting-edge research in the humanities now requires investment in expensive database infrastructures, and McGill's commitment to the proposed Chair and STIS research program are evident in its willingness to match the CFI funds needed to support such an expensive project. The proposed Chair and STIS research program have also been allocated three highly sought-after rooms in the ground floor of Morrice Hall. This decision was taken in order that the Chair and researchers associated with STIS can have immediate access to the human and bibliographic resources offered by the Islamic Studies Library, also located in Morrice Hall. It will also enable the proposed Chair and researchers associated with the STIS research program to engage in immediate collaboration with colleagues in the Institute of Islamic Studies, which is located in Morrice Hall.

Fit of the Proposed Chair with the Strategic Research Plan

As the hub of Islamic Studies in Canada, as well as one of the leading departments in North America, the Institute of Islamic Studies is one of McGill's crown jewels, and it is a precious asset to Quebec and Canada. PhD alumni of the Institute now hold tenured professorships at Harvard, Yale and Princeton as well as at many Canadian universities; just as important, they occupy high-ranking positions in government and academia throughout the Muslim world. In the past three years McGill has invested massively to reinforce the scholarly preeminence of the Institute of Islamic Studies, and the number of full-time faculty members has more than doubled in size, from five in 2003 to fourteen in 2006. Substantial further growth is anticipated in the next three to five years, with three new chairs in various aspects of Islamic Studies now included as priorities in McGill's incipient fundraising campaign.

The proposed Chair will help serve to "recalibrate" the Institute of Islamic Studies, in two senses. First, almost all of the recent growth in the Institute's tenure-track faculty ranks has been in the study of contemporary history (Professors L. Parsons and M. Abisaab), contemporary literature (Professor M. Hartman), contemporary anthropology (Professor S. Manoukian) and contemporary political science (Professor K. Medani). These new hires are all wonderful and very welcome additions to the Institute of Islamic Studies, and they have succeeded in redressing a previous imbalance here, where the modern period had long been ignored or marginalized, with most faculty attention paid to the classical and medieval Islamic periods. However, there is a danger that if this new trend is not counter-balanced by further appointments in the intellectual, artistic and religious traditions of classical and medieval Islamic civilization, the Institute will risk losing some of its cherished international reputation – particularly important to scholars and potential students from the Muslim world itself – as a center for hard-core historical and philological scholarship. Professor Ragep's appointment, and the proposed Chair and STIS research program, will help to strike exactly the right kind of faculty and research balance in the Institute

between the medieval and the modern, between the past and the present. Second, almost all of this recent growth in the Institute's faculty ranks has been at the junior, untenured level. Professor Ragep's appointment as a senior, tenured professor will therefore help to recalibrate the Institute in the sense of providing a more seamless generational continuity amongst scholars here who are at different stages of their career.

More generally, in its effort to recruit and retain key faculty members in the humanities and social sciences, McGill must devote a significant proportion of its overall CFI allocation to providing them with the infrastructure support they need in order to lead full and productive careers here. The STIS research program is an ambitious humanities infrastructure project that fits precisely into this aspect of McGill's strategic vision. More particularly, McGill's Strategic Research Plan emphasizes the promotion of the kind of interdisciplinary research that is found in Area, Period and Group Studies. This emphasis on interdisciplinarity, combined with the university's wish to support existing centers of excellence and its strong international focus, have made McGill's Institute of Islamic Studies – where STIS will be based – a top priority of the Faculty of Arts. The proposed Chair and STIS research program will also keep McGill at the forefront of database-enabled research in the humanities, and will thereby play an important role in helping McGill achieve its goal of securing a place among the world's top ten publicly funded research universities.

CFI module

Protected when completed

IDENTIFICATION

DESCRIPTION OF INFRASTRUCTURE PROJECT

Date: 2006-09-11 **File number:** 203634

University: McGill University

Nominee: Ragep, Faiz

Funding Program: Leaders Opportunity Fund **Funding Stream:** Canada Research Chairs

Descriptive title of infrastructure project (no more than 200 characters):

Scientific Traditions in Islamic Societies (STIS): Secularism and Rational Knowledge Structures as Integral to Premodern Islam

PROJECT OVERVIEW

In language appropriate for a multidisciplinary committee, use the space below (up to two pages, in the PDF printout) to provide a general description of the infrastructure requested and indicate where it will be located.
Briefly explain why the infrastructure is needed at this time, how it enhances any existing infrastructure, what research or technology development it will enable to be performed, and why that research or technology development is important for Cana

This research program aims to transform our understanding of the Islamic tradition of science and its role in premodern Islamic societies through studies of key texts and a database that will provide the technological means to achieve this transformation. STIS will create the infrastructure—unique in the world—that is needed for a systematic investigation of the vast but severely understudied corpus of Islamic scientific texts dating from 750-1900 CE. In its initial stages, STIS will focus on theoretical astronomy; in the next stage it will serve as the model for a comprehensive project on all the Islamic exact sciences that Ragep has initiated in collaboration with the leading international scholars in this field. Research questions for STIS revolve around: the development of a secular, scientific cosmology integral to Islamic societies; the transformation of Hellenistic astronomy in Islam that laid the foundation for modern science; and the evolution of the relationship between an independent science and Abrahamic revelation that is one of the cornerstones of modernism.

Up to now, most research on the scientific traditions in Islam has been on individual texts, mainly in the pre-1200 period. Little work has been done on the contexts (social, institutional, intellectual) in which those works were produced, in large part because of the difficulty of accessing or inspecting tens of thousands of manuscripts spread throughout the world in rare-book libraries and private collections. This research program will radically transform this state of affairs by making key astronomical texts available through editions, translations, and studies, and by answering fundamental questions about the role of secular cosmology in Islamic societies. For the latter, the methodology will consist of surveying all works on theoretical astronomy (some 500 titles in all, almost all still unstudied in manuscript) and examining a significant proportion of the manuscript witnesses (approximately 10 manuscripts per title or 5000 total). STIS will create a searchable database index of these 500 titles and 5000 manuscripts as well as database tables so linked to enable queries regarding authors, titles, manuscripts, key passages, patronage, copyists, teachers, students, translators, readers, institutions, geographical and chronological

Institution and title of infrastructure project (from page 1 of this module):

McGill University

Scientific Traditions in Islamic Societies (STIS): Secularism and Rational Knowledge Structures as Integral to Premodern Islam

PROJECT OVERVIEW (additional information)

distribution, and transmission of knowledge. This database will aid in the production of: a monograph on Islamic theoretical astronomy; an interactive online website that allows searching and sophisticated queries for both specialists and the general public; and an undergraduate textbook incorporating the most significant findings. This will transform our knowledge of science and Islam, allowing specialists in history of science, Islamic studies, medieval and early modern studies, cultural studies, and general history to incorporate this important aspect of Islamic Civilization into future secondary work discussing Islam and science. By creating the infrastructure necessary to complete this ambitious and innovative research program, STIS will help promote a much richer conception of Islam among both scholars and the wider public in the West.

Ragep has already edited and translated several of the key astronomical texts of this period and done a preliminary survey of all works dealing with theoretical astronomy based upon 30 years of research in libraries in Egypt, Syria, Turkey, Iran, Germany, the Netherlands, the United Kingdom, and the United States. He also has acquired an extensive microfilm collection of works in this genre totally some 15,000 frames (equivalent to approximately 30,000 pages). Though a sizeable number, it is only a small percentage of the 250,000 frames (some 500,000 pages) of the 5000 additional manuscripts (at an average of 50 folios/frames per manuscript) needed for a significant representation of the surviving texts in this genre. Each manuscript is unique since it was copied by hand. For editions, it is crucial to have multiple manuscripts. Furthermore each manuscript preserves precious and singular data since it contains information about ownership, teaching, readership, and so on. Thus as many copies as possible are essential for obtaining the meaningful statistical data needed for the sociological study of Islamic science envisioned by the STIS project. The 5000 additional manuscripts will be purchased in the form of microfilms or microfiches, or as CDs or DVDs of already scanned images; these images, in addition to Ragep's own collection, will constitute STIS's core data.

STIS will need a high-speed scanner to convert about 65,000 microfilm image-frames (50,000 through purchase plus 15,000 owned by Ragep) into computer-readable high-definition TIFF files. A dedicated server will also be needed to store those images as well as the already scanned images and to construct the database. Two technicians will construct the database by cleaning, coding, and entering the information contained in the scanned images. The first is the Metadata Editor, who will be responsible for indexing descriptive information on the author of the work, on the work itself, and on the individual manuscript copies. The metadata provide the basis for research on the bibliographical and sociological aspects of the Islamic astronomers and their works. The second is the Data Editor, who will be responsible for indexing the work's contents, according to folio and line number. The data provide the basis for research on the conceptual evolutions of Islamic science. Two part-time graduate-student Research Assistants will aid the editors. Finally, a Computer

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Database Specialist will work closely with the PL to refine the relationships between the tables of the preliminary version of the STIS database and to develop and test the data-entry forms used by the Data Editors as well as the output displays for the user.

Because STIS staff will need immediate access to McGill's extensive Islamic reference collection and to the PL, STIS will be located in three rooms in Morrice Hall, home to IIS. In one, the Metadata and Data Editors and the Research Assistants will use the scanner to convert the core data into high-definition TIFF files, load them onto STIS's dedicated server, and burn copies onto DVDs. Another room is where the Computer Database Specialist will develop and test the database forms and architecture; in addition, all the purchased materials and DVD copies will be stored there. Here the Metadata and Data Editors will also clean, code and enter the metadata and the data, aided by the Research Assistants. A third room connected to this workroom will serve as a small reference library used by the editors for immediate access to the basic resource materials on Islamic science. It will also serve as an overflow storage area.

STIS will for the first time provide the means to comprehend the role secular traditions played within Islam, and thereby ensure that this complex and dynamic intellectual tradition is finally understood by scholars and students as well as by all Canadians, Muslim and non-Muslim.

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NEED FOR THE INFRASTRUCTURE

The infrastructure is essential and appropriate for the proposed activities.

Using the space below (up to two pages in the PDF printout), address all of the following:

- The appropriateness of the infrastructure for the proposed activities, explaining why they cannot be supported with the existing infrastructure.
- The availability of similar infrastructure within the institution and the region.
- Where applicable, address issues of accessibility, complementarity, duplication, and sharing.
- The value added of an additional award in cases where the nominee/Chairholder has previously received an award through the LOF, New Opportunities Fund, Canada Research Chairs Infrastructure Fund, or Career Award. Specifically, results and outcomes of the previous award must be highlighted.

STIS will provide the infrastructure necessary for the Project Leader, F. Jamil Ragep to achieve an innovation in research: constructing the first comprehensive narrative account of the role of scientific cosmology within Islamic societies. This research will transform our view of Islamic intellectual history in particular, and the character of Islamic civilization in general. Because the core data to be indexed by STIS is vast in scope and complex in nature, the realization of these beneficial research outcomes first requires a significant investment in infrastructure. The core data comprise 250,000 microfilm, microfiches and electronic image-frames of the 5,000 manuscript copies of the 500 or so texts on theoretical astronomy/cosmology composed in the Islamic world between 750 and 1900 CE. Each of these 250,000 image-frames needs to be scanned and/or converted to TIFF files that can then be loaded onto a dedicated server and copied onto DVDs for safe storage. The core data required to construct STIS is so massive that purchasing, scanning, converting, and indexing it will require the full-time services of one Data Editor and one Metadata Editor, who will be engaged in building the database over the course of four years. The design and testing of the database forms and architecture will require the full-time services of one Computer Database Specialist for three months during the first year, and his/her part-time services for three years after that.

The equipment required for STIS includes one high-speed automated scanner with attached computer workstation, in its own dedicated and renovated room in Morrice Hall. The scanner and workstation will be used to convert the microfilm and microfiche images and the non-TIFF electronic images into TIFF files. Another room will contain the physical infrastructure necessary to ensure the safe storage of the microfilms and microfiches as they arrive and after they have been scanned, and also of the DVD copies of the newly scanned microfilms and microfiches. Also included in the infrastructure of this second room are two computer workstations for the two graduate-student Research Assistants who will be working part-time on the STIS and a third to be used by the Project Leader, the Data Editors, and the Computer Database Specialist, as needed. The Data Editor and Metadata Editor will each be allocated one workstation in a third dedicated room in Morrice Hall, because they will be working full-time

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during the four-year period while the STIS database is being constructed.

These three dedicated rooms for the infrastructure should be located in Morrice Hall, which contains both McGill's Institute of Islamic Studies (IIS) and the Islamic Studies Library (ISL). Built in 1882, Morrice Hall is one of McGill's premier heritage buildings, and it is included on McGill's Priority 1 Preservation list. Operational effectiveness also demands that STIS be located in Morrice Hall. This is because the Metadata and Data Editors will require immediate access to the relevant reference works and edited scientific texts and secondary sources contained in ISL, which contains Canada's largest single collection of Islamic materials. For consultation purposes the Metadata Editor will require immediate access to the Director of ISL, Adam Gacek, who is one of the West's leading authorities on Arabic Manuscript Studies, and a widely published scholar in the field of Arabic paleography and codicology; as well as to Mr Gacek's assistant, Steve Millier, who has extensive experience in purchasing and cataloguing microfilm and microfiche copies of Arabic manuscripts from libraries, collections and archives worldwide. Both Mr Gacek and Mr Millier are located in Morrice Hall. Again, for consultation purposes the Metadata and Data Editors will require immediate access to the Project Leader, whose office is in IIS, in Morrice Hall 027. Similarly, the graduate-student Research Assistants will themselves require immediate access to Mr Gacek, Mr Millier and Professor Ragep. Finally, the Computer Database Specialist will require immediate access to the Project Leader and the Metadata and Data Editors for consultation during the design and testing phases of the database.

Once the database has been completed and is fully operational, the Project Leader will be the primary user of the infrastructure. However, visiting scholars and other selected researchers will at that time also be able to visit IIS in order to gain full access to the infrastructure (i.e., not only the index but the linked image-frames as well), for the purpose of conducting their own research on Islamic science. It is possible that STIS will need to be extended beyond its original four-year period, so that further tranches of core data can be purchased by future Data and Metadata Editors and added to the database. However, if that does not happen, then the room the Data and Metadata Editors had used during the four years of the project could be used afterwards by visiting STIS researchers. For the reasons listed above, these other users of the infrastructure would, like the Data and Metadata Editors, require immediate access to ISL's collection of reference and other materials in Morrice Hall.

At present only two high-speed electronic image scanners would be available at McGill to STIS personnel. These two scanners are located in MacLennan Library, in a separate building that is not connected by open-access tunnel to Morrice Hall. Apart from having to transport valuable pieces of core data in the open weather, STIS personnel would have to compete for use of the two MacLennan scanners with McGill's undergraduate and graduate students. These two scanners are therefore unable to satisfy the heavy requirements of STIS. It should be mentioned that the need for some

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of the more expensive equipment and renovations listed in the STIS budget would be eliminated in the event that CFI approves funding for PIPDI, the Post-classical Islamic Philosophy Database Initiative, led by Prof. Robert Wisnovsky, Director of IIS. In particular, the microfilm, microfiche and DVD storage facility, the high-speed scanner, and the renovated storage and scanning room, each of which is listed in PIPDI's budget, would all be fully available for shared use by STIS should PIPDI's application prove successful.

No other similar infrastructure projects are under development elsewhere in the world, apart from PIPDI, whose database of philosophical (as opposed to scientific) texts is just now beginning to be constructed at McGill. STIS's uniqueness will ensure that it serves as a cornerstone for Islamic Studies and History of Science research in Quebec and Canadian universities, which have recently made major investments in recruiting in these fields. STIS will provide the infrastructure needed to give focus to the efforts of the rapidly growing number of researchers, both in Quebec (e.g., Patrice Brodeur, CRC at U. de Montréal) and across Canada (e.g., the future incumbent of the new Chair in Islamic Studies at U. of Alberta), who work on different aspects of Islamic thought.

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COLLABORATIONS AND PARTNERSHIPS

The collaborations and partnerships required to ensure that the proposed activities can be pursued successfully are appropriate and already in place or under development. The infrastructure requested will further support existing collaborations and partnerships, and help create new ones where appropriate.

Using the space below (one page in the PDF printout), address all of the following:

- What collaborations or partnerships already exist and are planned.
- What steps have been taken or will be taken to create or strengthen collaborations or partnerships.
- Why the infrastructure is essential to the collaborations or partnerships.

I.
STIS will serve as the cornerstone of two major international partnerships:
• Islamic Scientific Manuscripts Initiative (ISMI), Max Planck Institute for the History of Science, Berlin; PLs: J. Ragep, S. Ragep, and L. Daston. This project will be modeled after the STIS database and include all manuscripts in the exact sciences. There are currently 20 individual and institutional affiliates from 13 countries in North America, Europe, the Middle East, and South Asia.
• Fifteenth-Century Context of Copernicanism, also with the Max Planck Institute, bringing together a multidisciplinary group of 12 scholars from 5 countries for collaboration on a book dealing with this question from traditional European perspectives but also using the insights of STIS to examine interactions between Europe and the Byzantine, Islamic, and Jewish cultural spheres. There are 3 scheduled meetings between 2006 and 2008.
STIS will also benefit from the following partnerships:
• The Research Centre for the Written Heritage in Iran. Ragep serves as one of its scientific consultants and it is an institutional affiliate of the ISMI project. It will be an invaluable source for STIS since it will provide access to Iranian manuscript libraries, which contain the largest collection of Islamic scientific manuscripts.
• The Institute for the History of Arabic Science at Aleppo U., Syria. It is an institutional member of ISMI and Ragep serves as co-editor of their Journal for the History of Arabic Science. Their long-established tradition of editing manuscripts, the scholars and students working there on scientific manuscripts, and their microfilm collection will be major resources for STIS.
• Post-classical Islamic Philosophy Database Initiative (PIPDI) will provide STIS-associated researchers with access to the parallel textual traditions of Islamic philosophy. Since a sizable proportion of Islamic thinkers wrote on scientific as well as philosophical topics, STIS-associated researchers will benefit from consulting with PIPDI-associated researchers.
In addition, the Project Leader has ongoing collaborations that will directly benefit STIS:

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• An edition, translation & Study of the Planetary Hypotheses by Ptolemy, with Prof. T. Langermann (Bar Ilan U., Israel) and Prof. A. Jones (U. of Toronto).
• An edition, translation & study of the Risalah-i mu`iniyya and its Appendix by Nasir al-Din al-Tusi, with W. Thackston (Harvard) and S. Ragep (McGill).
• An edition and translation of the Epistle 3 (on cosmology) of the Brethren of Purity (Ikhwan al-Safa'), sponsored by the Institute of Ismaili Studies, London, UK.
• The Biographical Encyclopedia of Astronomers (Springer-Verlag, 2006). Ragep was the content editor for all the Islamic and some of the South Asian entries (157 in all) that is an important resource for the database.
• An edition and translation of the works of `Ali Qushji, sponsored by the Bilim ve Sanat Foundation, Istanbul, Turkey.

II. Ragep will contact P. Yachnin (McGill) to explore a partnership between the "Making Publics" Project and the Fifteenth-Century Context of Copernicanism. There are also plans to increase the partner institutions affiliated with the ISMI project.

III. There is a critical need for space and equipment to pursue these partnerships. The ability to have core data, teleconferencing facilities, travel funding, and data infrastructure personnel is essential to the strengthening and success of these collaborations.

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BENEFITS TO CANADA

The proposed activities have the potential to lead to:

- **benefits to society, health, the environment, quality of life, or public policy; OR**
- **increased economic activity.**

Using the space below (one page in the PDF printout), address all of the following:

- Describe expected benefits, how these will be realized, and the timeframe over which they are expected.
- Identify potential users of the technology developed or the research results.
- Where appropriate, provide plans for:
  - The translation of knowledge, including potential contributions to policy and practice;
  - The transfer of technology and skills, and the commercialization of products, services and processes.

The database and online website of the STIS research project are open source and their cutting-edge technology will be available to the anticipated cohort of new large-scale humanities database projects currently being conceived at Quebec and Canadian universities. It will thus provide a tangible economic benefit to Quebec and Canada by eliminating most of the costs associated with database development and testing and reducing these projects' anticipated budgets. STIS's database coding structure could also be made available and modified for use in state and manuscript archives and museums across Quebec and Canada.

More generally, STIS will significantly enhance Canada's reputation in the Muslim world as well as among the growing number of Canadian Muslims in three interrelated ways. First it will serve as concrete evidence that Canada takes seriously the great intellectual and cultural achievements of Islamic civilization. Second, it will show that Canada recognizes the urgent need to deepen and expand the West's understanding of Islam. Third, this research will reinforce the international prominence of McGill's Institute of Islamic Studies (IIS) by serving as the cornerstone of world research on Islamic scientific traditions.

Canada engages with the Muslim world on several levels, including business, government and NGOs. For 54 years the IIS has been a highly visible element of this engagement. The Institute has long been committed to creating and sustaining an academic environment that fosters scholarly excellence, open dialogue, intellectual freedom and methodological pluralism. It has consistently striven to reach out to Muslim scholars and students and to create links with individuals and institutions in the Muslim world. This has ensured that the Institute provides an academic space where Muslim and non-Muslim scholars and students can engage with one another productively and respectfully. The partner Islamic Scientific Manuscripts Initiative (ISMI) project, for example, brings together a healthy 50-50 mix of Muslims and non-Muslims representing 10 western institutions and 7 from the Islamic world. For the past 15 years, the IIS has been the leading player in the IAIN Indonesia Social Equity Project, funded by CIDA that led to over 100 graduate degrees being awarded to Indonesian students who studied at McGill and then returned to Indonesia to take up

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positions in government and at the State Institutes of Islamic Studies; they provide an effective and authoritative educational counter-balance to the Saudi-trained preachers working in mosques and Islamic religious schools throughout Indonesia.

The Institute's highly diverse and international faculty and student body, its celebrated openness and methodological pluralism, serve as a microcosm of the qualities that help make Canada a model for other nations that are struggling to meet their own challenges of ethnic and religious identity and pluralism. By demonstrating how rich, complex and variegated the rationalistic traditions of Islamic civilization were, this research program and the related Post-classical Islamic Philosophy Database Initiative (PIPDI) will help ensure that in both academic and public discourse Islam is seen to be as multidimensional as the West. In so doing this research program will promote mutual respect not only internationally but between Canada's diverse Muslim population and the other communities that make up the national mosaic.