McGill University

McGill University is an internationally recognized, world-class research institute. It is currently ranked the top university in Canada and is among the top twenty universities in the world (according to the QS World University Rankings). The undergraduate population is exceptional, as manifested for example by the fact that several former McGill undergraduates were recently awarded Nobel Prizes. There are extensive funding resources for graduate students and postdoctoral fellows, fostering an active and stimulating research and academic environment for Dr. Scott.

The Department of Physics

McGill's Department of Physics is a well-established and world-renowned department within McGill. It is one of the oldest physics departments in Canada, and has a record of forefront research going back to Rutherford. It has produced numerous Nobel Laureates, and shown consistent commitment to research excellence.

In the past decade the McGill Physics Department has undergone an extensive faculty renewal. Currently, more than 60% of the Physics faculty are people who were hired since the year 2000. Without exception, these faculty members are very active in research. The research funding level per faculty is the highest of any Canadian Physics department. This has enabled the Physics Department to recruit a large number of graduate students and postdocs. There are close to 150 graduate students, and thus McGill has the highest ratio of graduate students to faculty among Canadian Physics departments. The number of physics majors is exceptionally high (more than 60 per year) and of excellent quality (as measured e.g. by the fraction who continue to graduate school and by how well they then perform in graduate school). All these factors provide Dr. Scott with an extremely stimulating research environment.

Personnel

In the year 2000, McGill decided to invest in a new astrophysics group and has provided all of the resources required for this group to grow and form a true centre of excellence. It currently consists of eight faculty members (six of whom were hired in the period between 2000 and 2006), eight postdocs and more than 20 graduate students. At least four of the faculty have close research overlap with Dr. Scott: two of the faculty (Hanna and Ragan) are playing a key role in the high energy gamma ray telescope VERITAS collaboration, Professor Dobbs is one of the leaders in several cosmic microwave (CMB) temperature and polarization experiments, and Professor Holder is an expert on theoretical aspects of CMB and cosmic reionization research.

In the years following 2000, McGill also hired three new faculty in experimental particle physics (currently playing an important role in the ATLAS collaboration at the Large Hadron Collider). In the same period, the High Energy Theory group underwent a renewal with the hiring of Profs. Brandenberger, Moore, Dasgupta, Maloney and Walcher. Three of these High Energy Theory faculty have close research overlaps with Dr. Scott. Foremost is Prof. Cline, who is currently working on dark matter models as his main research priority. Prof. Brandenberger is a world-renowned expert on both early Universe and late time cosmology, both of which constitute essential inputs to Dr. Scott's proposed program of global fits. Prof. Moore is an expert on quantum field theory at finite temperature and density, which is also highly relevant for physics of the early Universe.

One of the most special things about the current research environment in the McGill Physics Department is the close connection between all research groups with interests relevant to Dr. Scott's proposal. The High Energy Theory group

interacts very closely with the Astrophysics Group, in particular concerning topics related to cosmology. Profs. Cline and Brandenberger are both directly collaborating with members of the Astrophysics Group. Members of the High Energy Theory group also maintain an active research collaboration with the Nuclear Theory group, led by Profs. Gale and Jeon. This particular resource will be especially valuable to Dr. Scott, because nuclear form factors are presently one of the largest uncertainties in the search for neutrinos from dark matter annihilation in the Sun, and in direct detection experiments. Thus, McGill provides Dr. Scott with a unique research environment, where all groups working on issues relevant to his research continuously collaborate and exchange ideas.

At McGill, Dr. Scott finds an ideal environment for the research program he plans to carry out. His research must draw on the expertise of people in quite varied areas: dark matter theory (Prof. Cline), indirect detection (Profs. Hanna and Ragan), cosmological aspects (Profs. Brandenberger and Holder from the theory side and Prof. Dobbs from the experimental side), collider constraints (Profs. Vachon, Warburton, Corriveau and Robertson from the ATLAS group), and quantum field theory (Professors Cline, Moore, Jeon and Gale). Experts on direct dark matter detection are located across Mt. Royal at the Université de Montréal (the PICASSO experiment). This unique combination of in house expertise and research strengths is extremely valuable for Dr. Scott (who turned down a postdoctoral fellowship at Harvard to come to McGill, specifically because he felt McGill offered a superior environment for his research program).

Likewise, McGill also has a special interest in having Dr. Scott here in Montreal. Dr. Scott is **THE** person who can provide the link between all of the research groups mentioned above. In particular, he is forging new links (e.g. a new seminar series) between particle physics, astrophysics and high energy theory.

At McGill Dr. Scott has the chance to work with many excellent graduate students, both from the High Energy Theory and the Astrophysics groups. He has already identified a core group of 4 students that would be heavily involved in the work he proposes here.

Facilities and Funding

Dr. Scott will have full access to a computer cluster recently purchased by the High Energy Theory group with applications to astrophysical and cosmological simulations in mind. The Astrophysics Group has a larger cluster used extensively for data analysis, which Dr. Scott will also have full access to. The Department provides two computer technicians who look after these computer clusters. Thus, there are excellent computational resources within the Department for Dr. Scott's research. McGill is a member of the CLUMEQ High Performance Computing network (linking several Quebec institutions), and the new director of CLUMEQ is a member of the Physics Department. Dr. Scott will also have access to all of CLUMEQ's facilities.

Dr. Scott will be provided with a $10k annual research budget, which can be used for travel, computing hardware or inviting collaborators. The Department has 5 full-time administrative staff, all of whom will be available to assist Dr. Scott in administering his Fellowship, whether regarding paperwork, travel, workshop/conference organization or hosting guests.