Vision for the New England Space Science Consortium

The New England Space Science Consortium (NESSC) creates a cross-disciplinary, multi-institutional forum to address cutting edge research topics with a broad view toward collaboration on major opportunities in solar and space science. The consortium brings together researchers and students at Boston University (BU), the Harvard-Smithsonian Center for Astrophysics (CfA), the MIT, the Air Force Research Laboratory (AFRL) at Hanscom AFB, the University of New Hampshire (UNH), Dartmouth College, the Haystack Observatory, and Tufts University.

The consortium is a grass roots organization founded by Nathan Schwadron and Nancy Crooker at Boston University, John Raymond at CfA, Justin Kasper at MIT, Chuck Smith and Eberhard Moebius at the UNH, and Mary Hudson at Dartmouth College. The group has begun a series of informal monthly meetings in which highly relevant, interdisciplinary research topics are presented and discussed. The consortium's broad scope has, thus far, engaged researchers from the solar, heliospheric, solar wind, magnetospheric and ionospheric communities. Continued growth in the consortium's scientific breadth and depth will be encouraged.

There are a number of notable examples of interdisciplinary areas that will be pursued by the consortium

- There is considerable interest in a new direction that our field is taking toward establishing plasma physics of the local cosmos as a basic science. Physical processes such as magnetic reconnection, turbulence, and plasma-neutral coupling occur in diverse astrophysical settings, including accretion disks surrounding compact objects such as neutron stars and black holes, shocks surrounding supernovae and gamma ray bursts, and superheated plasmas within globular clusters and the intergalactic medium. There is significant potential for the generalization or "universalization" of such processes. Given recent progress and interest, magnetic reconnection has been the focus of much discussion. Magnetic reconnection is critical for changing global magnetic topologies in the solar corona and magnetosphere and is responsible for transferring stored magnetic energy into plasmas, causing heating and perhaps explosive events like flares. This research complements new laboratory reconnection experiments and aids in our understanding of exotic processes such as angular momentum transport in accretion disks.

- There are inherent connections between space science and astrophysics. Energetic particles and cosmic rays are accelerated within our solar system and the heliosphere in much the same way as they are throughout the galaxy (for instance, at supernova shocks, thought to be the dominant source of galactic cosmic rays with energies below 10^{14} eV). Similarly, our Sun is our nearest star and understanding its physics is a starting point for understanding stars throughout the galaxy and the universe. Understanding our heliosphere and its interaction with the interstellar medium is a starting point for understanding the "astrospheres" around other stars. These examples of the connections between space physics and astrophysics are by no means exhaustive. Such examples become increasingly relevant as our physical understanding of these systems becomes more detailed and as we inexorably develop more sophisticated observational techniques.

Indeed, it is through the development of a more accurate and detailed physical picture that we begin to understand our vast and inherently connected universe.

- Our Sun is highly dynamic on timescales of billions of years down to seconds. Its vast magnetic re-organization, which occurs continuously and cyclically (e.g., over the 11-year solar cycle), leads to the periodic release of large eruptive events called Coronal Mass Ejections (CMEs). CMEs occur most frequently near solar maximum. These events can carry strong magnetic fields and can cause strong shocks to form in the interplanetary medium. The strong fields and shocks, in turn, disrupt Earth's magnetosphere and the atmospheres and/or magnetospheres of planets throughout the solar system. The CME shocks also accelerate high-energy particle radiation that is extremely dangerous to astronauts. CMEs, shocks and energetic particle radiation are all forms of "space weather", which we are learning more about by the day. We want to know how to predict space weather to protect our growing space-based infrastructure and future explorers that will venture to the Moon and beyond as a part of NASA's vision for space exploration. We want to understand the implications and connections of space weather to our planet, its electrodyanmic environment, its weather, and its evolution.

In all of these areas, an intellectual dialogue that cuts across the traditional boundaries of space science is essential. In this respect, the New England area is fortunate to have such diverse research groups in space science that can come together in an interdisciplinary, multi-institutional forum and bring their collective resources to bear on critical topics.

The format for discussion in the New England Space Science Meetings has evolved and will continue to do so. Recent meetings have taken place in the Boston area, and often involve one to two hour discussions and lunch. This format provides a friendly atmosphere where colleagues can become more familiar with one another, forge new collaborations, raise questions, and share information and insights. The forum also presents a unique opportunity to provide students with a broad view of the field of space science. In the future, it is anticipated that one or more half-day or full-day workshops will be convened annually.