KARL-FRANZENS-UNIVERSITÄT GRAZ
UNIVERSITY OF GRAZ
Institut für Physik | Geophysik, Astrophysik und Meteorologie

Das Institut für Physik

Institutsbereich Geophysik, Astrophysik und Meteorologie

lädt zu folgendem Vortrag

im Rahmen des **Astrophysikalischen Kolloquiums** ein:

"Solar / Stellar Eruptions and Planetary Forcing: a First Principles, Unifying Approach"

Dr. Manolis K. Georgoulis

Research Center for Astronomy and Applied Mathematics
Academy of Athens, Greece

We present an overview of recent efforts to understand coronal mass ejection (CME) occurrence and propagation into the inner heliosphere, along with their magnetic compression effect on Earth and other planets of the solar system. The approach steps firmly on the fundamental principle of magnetic helicity conservation in high magnetic Reynolds number plasmas, that should be valid in any astrosphere beyond the Sun's heliosphere. However, as stellar CME evidence is scarce, we rely again on a semi-empirical monotonic relation between the available-for-release (i.e., electric-current-based, or free) magnetic energy and the relative-to-vacuum magnetic helicity in solar active regions to connect observed bolometric stellar flare energies with the helicity content of possible associated CMEs. This results in an estimation of the CMEs' axial magnetic field and corresponding magnetic pressure at any vantage point within astrospheres, including the orbital locations of confirmed exoplanets. These planetary bodies could be assigned any magnetosphere-sustaining field strength to gauge whether they could sustain an atmosphere under the action of extreme stellar eruptions stemming from their mother stars. For tidally-locked, terrestrial exoplanets, a best-case scenario planetary magnetic field can be inferred, whose pressure is juxtaposed against the worst-case stellar CME eruptions. This results in a (magnetic) atmosphere sustainability criterion for these apparently terrestrial exoplanets. Several famous cases are examined, to conclude that tidal locking could be a showstopper for the preservation of an atmosphere under persistent, intense stellar weather. The methodology is simple and readily reproducible and enables a fast but educated screening of large exoplanet databases in efforts to determine which ones could be more promising for sustaining an atmosphere and, ultimately, life.

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assoc.-Prof. Mag.Dr. Manuela Temmer
Universitätsplatz 5/II, 8010 Graz, Austria

Tel.: +43 (0) 316 / 380-8610
E-Mail: manuela.temmer@uni-graz.at