EURYI Awards 2004

Press Information

Dr. Svetlana BERDYUGINA

– Astrophysics –

Project:

Molecules in Magnetized Solar and Stellar Atmospheres

We propose to develop a new field in stellar astrophysics aiming at studying solar and stellar magnetism by means of molecular spectroscopy. Molecules are found in a large variety of astronomical objects, ranging from comets in the solar system to galaxies at high redshifts and including the Sun, cool active stars, brown and white dwarfs. In the presence of a mag-netic field many molecular lines exhibit the Zeeman effect and, thus, are useful to diagnose cool magnetized stellar atmospheres. Although recently significant progress has been made, the quantum theory of the molecular Zeeman effect is still not fully developed, especially for strong magnetic fields. We propose, therefore, to extend the theory of the molecular Paschen-Back effect and develop new diagnostic techniques for studying solar and stellar magnetic fields based on this theory. In particular, for the Sun we propose to use molecular lines for probing coolest parts of sunspots as well as for studying magnetic concentrations and turbulent magnetic fields outside sunspots. For cool stars with magnetic activity, we propose to use molecular lines for direct measurements of magnetic fields in spatially unre-solved starspots and for studying the magnetic activity of fully convective stars. Finally, we propose to study cool magnetic white dwarfs with molecular bands and investigate molecular properties at field strengths of several Mega Gauss, which is not yet achieved in laboratories.

Comments:

A very original proposal which pioneers the application of molecular magneto-spectroscopy in astrophysics by measuring magnetic fields in cold regions (from brown dwarfs and planets to molecular clouds).

Dr. Berdyugina has shown good scientific vision by both identifying and attacking a field that few other astrophysicists have tackled. She has a very strong background in theory and her experience in spectroscopy will prove useful for future studies of inter-stellar medium and proto-planetary disks.

The role of magnetic fields remains an important and poorly understood issue in astrophysics. This proposal is ground-breaking in that it opens up the possibility of studying magnetic fields in a variety of settings, from sun spots to molecular clouds.

ETH-Zurich is one of the leading institutions world-wide in those areas and has developed the necessary instrumentation and carried out the necessary observations to support this work**.**

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