SFB 956
Cologne | Bonn

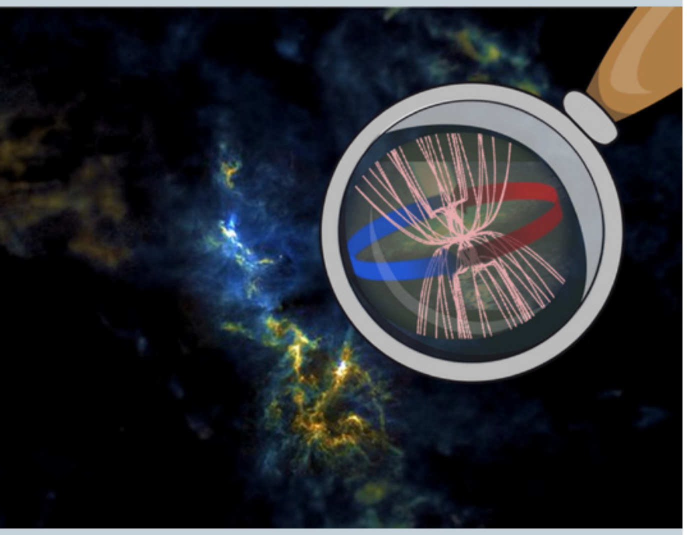
Colloquium

SFB 956

Conditions and Impact of Star Formation

23 Jan 2017
Monday 3:00 pm

Max-Planck-Institut für Radioastronomie
Auditorium 0.02
Auf dem Hügel 69 | 53121 Bonn



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Addressing the Angular Momentum Problem During the Main Accretion Phase: Insights from Interferometric Studies of Class 0 Protostars

Class 0 protostars are the first (proto)stellar objects, observed only t<0.1 Myr after their formation, while most of the mass is still in the form of a dense core/envelope collapsing onto the central protostellar embryo. The Class 0 phase is also the main accretion phase, during which most of the final stellar mass is accreted onto the central protostellar object. Therefore, during the Class 0 phase, the accreted circumstellar envelope must redistribute most of its initial angular momentum outward, or centrifugal forces will prevent further accretion onto the protostar: how this is done exactly is still an open question, known as the long-standing angular momentum problem for star formation.
Several key questions about the typical outcome of protostellar collapse, tied to this angular momentum problem, still remain open, such as the initial conditions for building protostellar disks and binary systems, which are routinely observed at the later stages of evolution. Solving not only these questions, but also understanding the typical outcome of protostellar formation, and therefore the formation of most stars, ultimately depends on characterizing the forces at work to regulate the angular momentum content and evolution during the Class 0 phase.
I will present new insights on the possible solutions to the angular momentum problem, obtained thanks to the detailed analysis of millimeter observations of protostellar envelopes probing the envelope density, structure and kinematics from the small scales (50 au) to large scales (5000 au) obtained mostly with the Plateau de Bure interferometer (PdBI) and the IRAM 30m telescope in the framework of the CALYPSO (Continuum and Line in Young Protostellar Objects, see http://irfu.cea.fr/Projets/Calypso/) program.
While the presence of large accretion disks is well documented in more evolved Class I objects and T Tauri stars, I will show that the detection of the large (r >100au) Keplerian disks expected from conservation of angular momentum during protostellar collapse, have remained elusive around Class 0 protostars. I will also present recent SMA and ALMA observations of magnetic fields in Class 0 protostars at scales 20-10000 au, arguing that the small disk sizes observed during the main accretion phase are in favor of a magnetically-regulated collapse scenario for the formation of most low-mass stars.

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