ST. FRANCIS XAVIER UNIVERSITY

Physics Colloquium

Friday, February 11, 2011, 4:00 pm, PS 3046

Prof. David Clarke

Institute for Computational Astrophysics
Saint Mary's University

Magnetohydrodynamics simulations of protostellar jets

Astrophysical jets are long, highly collimated outflows from newly-formed compact objects. From protostellar objects, jets can reach 1 pc in length, while from nascent galactic cores, they can exceed 1 Mpc. Jets represents a transient phase of almost any astrophysical collapse, and is nature's way to relieve the condensing object of sufficient angular momentum to allow collapse to continue to form stars and galaxies. Without jets, we wouldn't be here talking about them.

After a quick tutorial on magnetohydrodynamics (and the numerical methods used to solve the equations), I will present the first MHD simulations of protostellar jets that include both the region in which the jet is launched (at scale lengths < 0.1 AU), and where the propagating jet is observed (at scale lengths > 1000 AU). These simulations reveal interesting relationships between the magnetic field strength near the the launching site of the jet, and direct observables such as proper motion, rotation, radius, and mass flux of the jet. More importantly, these are the first simulations to confirm that "gravito-magneto-centrifugal forces" are both necessary and sufficient to launch protostellar jets as we know them.