TITLE: Formation of cold clouds and their substructure.

ABSTRACT:

I will review recent theoretical work on the formation cold atomic and molecular clouds and their substructures -- filaments and dense clumps. At least under Solar Circle conditions, the convergence of large-scale gas streams in the diffuse medium, caused by either turbulent motions or larger-scale instabilities, may coherently trigger the production of large extents of cold gas through thermal instability. The clouds may thus quickly acquire masses much larger than their thermal Jeans mass, engaging in large-scale, nearly pressureless, gravitational contraction. Under these conditions, collapse proceeds along the shortest dimension first, sequentially forming filaments and then clumps. Gravitationally-formed filaments grow in mass until they become locally unstable, forming the clumps. The remainders of the filaments then accrete onto the clumps, because an elongated structure has a longer free-fall time than a spherical one. The clumps themselves grow in mass in such a way that their early, pre-stellar stages resemble Bonnor-Ebert spheres. Clumps formed by this mechanism appear nearly virialized, but the nonthermal motions in this case do not represent true turbulent, random motions, but instead are dominated by infall, superposed on a moderately turbulent background. A low star formation efficiency can be maintained because stellar feedback is capable of shutting off local star formation events after roughly 10% of the local gas mass has been converted into stars, at least for low- to intermediate-mass clouds. To conclude, I will by briefly compare this scenario with the alternative view of clouds in approximate virial equilibrium, controlled by supersonic turbulence.