RAPID PROTOSTELLAR COLLAPSE AND THE ORIGIN OF CALCIUM- ALUMINIUM RICH INCLUSIONS. H.-P. Gail[1], M. Trieloff[2], W.M. Tscharnuter[1], J. Schönke[1], and E. Lüttjohann[1]. [1]Institut für Theoretische Astrophysik, Univ. Heidelberg, 69120 Heidelberg, Germany (gail@ita.uni-heidelberg.de). [2]Institut für Geowissenschaften, Univ. Heidelberg, 69120 Heidelberg, Germany.

CAIs are a fundamental - though rare - ingredient of chondrites. They consist of mineral assemblages which are expected for high temperature (>1600 K) solar nebula condensates, are considered as oldest solar system material [e.g., 1] and apparently formed over a relatively short time interval as indicated by their canonical $^{26}Al/^{27}Al$ ratio of $5.23\pm0.13 \times 10^{-5}$, implying a formation time interval of < ±20 ka only [2]. However, their detailed formation setting is basically unknown, and it is also mysterious how they could dynamically be transported from supposed formation regions in the inner solar system outwards to chondrite forming regions, and survive a few Ma before they became incorporated into carbonaceous chondrite parent bodies, particular as cm-sized objects are susceptible to strong radial drift forces.

We present new calculations of the collapse of rotating molecular cloud cores with axial symmetry, including the 2nd collapse of the core to stellar dimensions and with sufficient resolution to follow up the inner disk formation on planetary system scales [3]. The model considers hydrodynamics, radiative transfer, thermodynamics, and realistic opacities. Our results show (1) A well defined preplanetary disk extending out to several AU is formed during collapse within a period of the order of about 3 ka, which is decisively shorter than the widely assumed timescale related to the so-called "inside-out collapse"; (2) during its initial build-up phase the inner disk (<4 AU) is rather hot for a period of a few ka following 2nd collapse; (3) due to the specific pattern of the accretion flow, material that has undergone substantial chemical and mineralogical modifications in the hot (>900 K) inner part may have a good chance to be advectively transported outward into the cooler remote parts (>4 AU, say) of the disk and to survive there until it is incorporated into a meteoritic body. The model provides for the first time the initial temperature and density structure of the accretion disk and the flow pattern in the disk and its surroundings, including the accretion shocks, during the very first stages of evolution on scales <<1 AU. It shows that from the beginning on there is both, accretion and a large-scale transport of matter close to the mid-plane from hot inner regions, hot enough for formation of materials like CAIs in meteorites, outward to distances of several AU from the centre. The model therefore seems to offer also an explanation how the short CAI-forming period in the Solar Nebula is related to the early evolutionary phase of the accretion disk. Though other disc activities may provide high temperature energetic events (e.g. FU Orionis outbursts), they mostly were active on significantly longer time scales, and appear unsuitable to explain why CAIs formed over such a restricted time interval of ±20 ka only.

References: [1] Amelin Y. et al. 2002. *Science* 29: 1678–1682. [2] Jacobsen B. et al. 2008. *Earth and Planetary Science Letters* 272: 353-364. [3] Tscharnuter W.M. et al. *Astronomy and Astrophysics*, arXiv:0903.4580.