OVERCOMING THE ACCRETION BARRIER IN PROTOPLANETARY DISCS BY CONDITIONS PREVAILING AT CHONDRULE FORMATION. M. Trieloff	extsuperscript{1}, J. Blum	extsuperscript{2}, H. Klahr	extsuperscript{3} \textsuperscript{1}Institut für Geowissenschaften, Univ. Heidelberg, 69120 Heidelberg, Germany (trieloff@min.uni-heidelberg.de). \textsuperscript{2}Institut für Geophysik und extraterrestrische Physik, TU Braunschweig, Germany. \textsuperscript{3}Max-Planck-Institut für Astronomie, 69117 Heidelberg, Germany.

To form planets in protoplanetary discs, micrometer sized dust particles need to grow by hit-and-stick collisions to km sized planetesimals, followed by further proto-planetary growth by gravitational forces. A serious obstacle of coagulation of large bodies is their increasing collision velocity: while larger bodies orbit with Keplerian velocity, small dust couples to the gas that rotates with sub-Keplerian velocity [1]. Increasing velocity differences impede further growth in two respects: i) sticking by weak surface forces becomes ineffective during high velocity collisions, and i) larger particles experience gas drag and head wind causing radial drift and final loss of this material into the central star. This theoretical problem is confirmed by our coagulation experiments which indicate that growth beyond dm sizes is prevented by collisional destruction of the dust aggregates which collide with a few m/sec, i.e. at relative speeds expected for disc models with standard gas-to-dust ratios of \(\sim 100\) [2].

This problem rises the question by which mechanism planetesimals formed in the early solar system. Recent studies demonstrate that mm-sized chondrules formed at conditions with significantly enhanced dust-to-gas ratios [e.g., 3-5], which can be derived from i) lack of isotopic fractionation of elements like Si and K, ii) Na content, iii) abundance of compound chondrules and iv) thermodynamic stabilization of chondrule melts. Chondrules obviously formed at significantly enhanced dust-to-gas ratios (higher than a factor of 1,000-10,000) in regions probably few 100 km to few 1,000 km across [4]. Isotope chronology and modeling of internal parent body heating further tell us that meteorite parent bodies formed over few Ma, but parent body accretion apparently followed rapidly the formation of its individual chondrule population [6,7], a concept also supported by chemical complementarity [8,9]. This indicates that dust enrichments prevailing at chondrule formation potentially prevented collisional fragmentation and supported accretion to chondrite parent bodies, possible by mechanisms like gravoturbulent accretion [10,11].