Dust formation and the emergence of ionised clouds in atmospheres of planetary objects

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Brown dwarfs and extrasolar atmospheres are forming clouds that can be very different from clouds on solar system planets. Such clouds resample what is commonly know as 'comsic dust' in form of mineral particles of varying sizes. Recent observational effords point to the need of a fundamental modelling bejond the widly used S=1-ansatz in modelling ultra-cool atmospheres and their spectral energy distribution. We have therefore developed a cloud formation model that treats
– seed formation (nucleation) via the formation of larger and larger clusters,
– growth/evaporation through gas-solid surface reactions
– element conservation
– gravitational settling,
which allows for a detailed modelling of material composition, cloud particles sizes, number of dust particles and the feedback on the local gas chemistry. While cluster data for nucleation modelling (seed formation) can be obtained via computational chemistry methodes, material data required to model the surface growth, like reaction efficiencies for individual surface reactions, are sparcely available. The impact of data uncertainties on cloud properties like grains size and number will be demonstrated. Recent developments in charge and discharge processes in ultra-cool atmosphere that might influence the cloud particle population, their chemistry as well as the gas-phase chemistry will be discussed.