

QUASI-STATISTICAL SOLUTION OF EARLY HOMOGENEOUS  
NUCLEATION PHASES

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ABSTRACT. Time-dependent nucleation processes have been a challenging problem, for which no general solution is available so far. Partial solutions have been obtained by various authors with a handful of simplifying assumptions. Apart from physical hypothesis, which are generally accepted and will not be discussed here, actual solutions are based on assumptions of a numerical and algebraic nature, whose validity and consequences remain to be established.

This paper is concerned with the numerical aspects of the problem, specially in the small cluster region, and within physical constraints which are adequate for astrophysical environments. Most important of these is the temperature time-dependence, which is assumed to be sufficiently slow to allow the definition of a quasi-static process. We show that for clusters smaller than a limiting size, the time derivative of the ratio between the actual and equilibrium concentrations may be neglected. As a consequence the system of differential equations becomes a set of algebraic non linear equations. The solution of the algebraic approximation is shown to approximate very closely the numerical integration gives good estimates for the time-constants of the concentrations variation.

*Key words:* NUMERICAL METHODS

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