

Larson R B. Numerical calculations of the dynamics of a collapsing proto-star. *Mon. Notic. Roy. Astron. Soc.* 145:271-95, 1969; and Larson R B. The emitted spectrum of a proto-star. *Mon. Notic. Roy. Astron. Soc.* 145:297-308, 1969. [Mount Wilson and Palomar Observatories, Carnegie Institution of Washington, California Institute of Technology, Pasadena, CA]

Calculations of the collapse of a spherical protostar show that a very small core forms and grows into a star by accreting gas from an extended infalling envelope. During most of its development the forming star is observable only as an infrared source. [The SCJ® indicates that these papers have been cited in over 300 and 70 publications, respectively.]

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These papers are based on my PhD thesis, which was completed at the California Institute of Technology in 1968. The project was suggested by my thesis adviser, Guido Münch, who, after listening to my more grandiose ideas about trying to model the formation of galaxies, wisely suggested that I first try to understand the formation of a single star. The problem posed was to calculate the collapse under gravity of a protostar, a dense clump of interstellar gas that is destined to become a star. Numerical techniques capable of solving similar problems had been developed for nuclear weapons research, and when I began my thesis work in 1965, they had recently been used by R.F. Christy of Caltech to study stellar pulsation. Recent work by J.E. Gaustad¹ and by C. Hayashi and T. Nakano² had also clarified the thermal and radiative properties of protostars, so the time was ripe for a full numerical attack on the problem of protostellar collapse.

Armed with general advice from Münch, pointers on numerical technique from Christy, advice on radiative transfer problems from fellow graduate student John Castor, and previous experience in stellar evolution obtained with Pierre Demarque at the University of To-

ronto, I began work on the problem in late 1965. Stimulated by the intense and somewhat heady atmosphere of Caltech in the 1960s, I completed my first collapse calculation a year later (after working around the clock to finish it before the Caltech Computing Center closed for the Thanksgiving holiday in 1966). I was elated at having completed the first calculation that began with an interstellar cloud and ended with a star.

Controversy surrounded my results after their publication in 1969, and it was not settled until two independent calculations yielded similar results in 1980. Work went forward in this field during those intervening years.^{3,4} Meanwhile the hunt had begun for the predicted "accreting protostars," which have been called the "Holy Grail" of infrared astronomy.⁵ While there is now much evidence for dense protostellar clumps, and while many of them even contain infrared sources and evidently have already begun to form stars, evidence for the predicted infall of gas has remained elusive. Instead, observers have come up with much evidence for *outflows* from young stars, a phenomenon not predicted by the theory. So there has been plenty of discussion about the relevance of the collapse calculations. The resolution of these discrepancies is only now becoming evident, and it involves the effects of rotation and magnetic fields, both of which had originally been neglected. With rotation, accretion onto a forming star occurs by the gradual inward spiraling of gas from a circumstellar disk; and if a magnetic field is entrained in this disk, magnetohydrodynamic effects can lead to the ejection of some of the gas. In this way, outflows actually provide evidence for the continuing accretion of gas onto a forming star.

The main reason my work has been widely quoted is undoubtedly its timeliness. It was one of the first studies of the dynamics of star formation, and many developments that were just beginning at about the time it was done have since transformed the study of star formation into a booming enterprise.

[For more recent work in this field, see references 6 and 7.]

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3. Larson R B. Processes in collapsing interstellar clouds. *Annu. Rev. Astron. Astrophys.* 11:219-38, 1973. (Cited 80 times.)
4. Bodenheimer P & Black D C. Numerical calculations of protostellar hydrodynamic collapse. (Gehrels T, ed.) *Protostars and planets*. Tucson: University of Arizona Press, 1978. p. 288-322. (Cited 55 times.)
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6. Larson R B. Gravitational torques and star formation. *Mon. Notic. Roy. Astron. Soc.* 206:197-207, 1984.
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