# Resonance Effects in Fundamental Mode, First-Overtone, and Double-Mode Cepheids

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## Abstract

Linear adiabatic periods, period ratios and frequencies of Cepheid models with $P_0$ less than about 10 days have been computed, taking into account standard and nonstandard mass-luminosity relations and the new (or augmented) opacities. A comparison of the results with the observed properties of Cepheids has yielded the following conclusions:

(a) A non-standard mass-luminosity relation is needed in order to have good agreement between observed stars and models on the temperature–period (or luminosity) diagram; 'standard' models have much lower temperatures and luminosities than observed stars.

(b) The linear models predict the following resonances: $f_2/f_0 = 2$ (well known) at $P_0 \sim 10$ days, $f_4/f_0 = 3$ at $P_0 \sim 6.8$ days, $f_4/f_1 = 2$ at $P_1 \sim 3.2$ days, and $f_1 + f_0 = f_3$ at $P_0 \sim 6.5$ days.

(c) All these resonances yield effects which have been observed in light curves of Cepheids *at the predicted periods*: $f_2/f_0 = 2$ and $f_4/f_0 = 3$ in classical Cepheids; $f_4/f_1 = 2$ in first-overtone Cepheids; and $f_4/f_1 = 2$ and $f_1 + f_0 = f_3$ in double-mode Cepheids.

The discussion will include comparison with the results obtained with nonlinear models by Moskalik *et al.* (1992) for fundamental-mode Cepheids, and by Aikawa (1992) for first-overtone Cepheids.

## References:

Aikawa T. 1992, in *Nonlinear Phenomena in Stellar Variability*, eds. M. Takeuti & J.R. Buchler, I.A.U. Coll. 134 (Mito, Japan), in press.

Moskalik P., Buchler J.R. & Marom A. 1992, ApJ, 385, 685.