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Zeta Cancri

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ABSTRACT: **Zeta Cancri is a multiple system in which the well–observed orbit is an inner, or close one. Three-body coupling effects are an order of magnitude more significant for the close orbit in a hierarchical system, and they must be included. An exact numerical integration is very easy and requires no approximations. Inclusion of these effects improves the residuals for this system.**

1. DISCUSSION

Zeta Cancri is a quadruple stellar system consisting of a close binary of two approximately solar–type stars and another very close binary of a solar–type star and a probable white dwarf. This second binary is unresolved and for present dynamical studies may be treated as a single object. The last complete treatment of the system was by Gasteyer (1954). The residuals for the orbit of the close pair are now showing trends that can not be modelled by two–body motion, and the system must now be treated as a full three–body problem. Given that the inner orbit of a hierarchical triple exhibits an order of magnitude more dynamical variation than the outer one, it is to be expected that the AB orbit of this system would be showing the systematic trends.

There are many good analytical ways to treat this system as a variation–of–elements problem, but they all require admittedly very valid assumptions. This problem can also be treated in a completely closed form as a numerical integration exercise, as was shown by Harrington (1991). The first step is to carry out a new differential correction of the binary (AB) orbit, giving the following elements:

TABLE 1. Orbital Elements of ζ Cancrii AB

Period (years)	59.7
Periastron epoch	1930.0
Semimajor axis	0″.872
Eccentricity	0.319
Inclination	168.9
Argument of periastron	222.7
Position angle of node	47.7
Epoch of node	2000.0
Epoch of osculation	1923.7

The individual observations from the *Observation Catalog* were grouped into annual normal points in the usual manner. The above orbit for the binary, along with Gasteyer's orbit for the tertiary, were used to integrate the system to each normal epoch, using the formalism given by Harrington. New residuals were then computed. While the formal scatter decreased only from 0".021 to 0".019, the systematic trends at either end of the data set were significantly reduced.

2. REFERENCES

Gasteyer, C. 1954, *AJ*, **59**, 243
Harrington, R.S. 1991, *AJ*, **101**, 1063

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