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ON THE NAME "OVER-CONTACT BINARY SYSTEMS"

During the recent years, a new name of a group of binary stars seems to have appeared. These are "over-contact binaries". The name is clear and persuasive in its content: Since contact binary stars exists, the new name implies existence of binary stars that are in better or "more" contact than ordinary contact systems. In this note I would like to express the opinion that the name is currently being used incorrectly and that it should be reserved for possible cases of genuine overflow of the outer critical equipotential surface.

The name in question has been surfacing from time to time in the literature, but has been particularly frequently used recently in the IBVS. A brief look at the titles starting with the issue number 4301 and continued to the most recent available number 4433 shows that it has been used in five instances (issues numbers 4324, 4364, 4365, 4424, 4427). In all these cases normal contact binaries of the W UMa-type are described. Not a single case indicated overflow through the external Lagrangian point L_2, arguably a reason to call a system an "over-contact" one.

The basic groups of close binary stars have been discussed and defined by Kopal (1959) in his monumental book. They have been divided into detached, semi-detached and contact systems according to the relation to the critical equipotentials passing through the inner critical point L_1. These potentials, known also as "Roche lobes", although invisible and not material, act as lips dividing the connected vessels (cf. Pringle 1985, Fig. 1.4). The group of contact binaries was defined clearly by Kopal (1959, Sec. VII.6) as systems filling the common envelope encompassing both stars. The observationally-defined group of W UMa-type eclipsing binaries was equated there with the theoretical concept of contact binaries, i.e. binaries whose surfaces are described by potentials intermediate between those that pass through the critical Lagrangian points L_1 and L_2.

The meaning of the contact systems has gained a real solid basis after the two seminal papers by Lucy (1968a, 1968b) who showed that single structures with two mass centres can exist and can produce light curves exactly as those of the W UMa-type. Since then a large body of literature on contact binary stars has appeared. The name of W UMa-type systems has attained the status of an operational definition of contact binaries with orbital periods shorter than one day which consist mostly of solar-type stars, whereas the name of "early-type contact binaries" is used for rare systems with orbital periods longer than one day.

Apparently, the new name originated through the incorrect application of the name "contact" to describe the relation of a star to its equipotential surface. Thus, the phrase "to be in contact" has been sometimes used to describe that the surface of a star is *in contact with the particular (critical) equipotential*; correspondingly, the component filling its Roche lobe would be then called a "contact component". This usage is illustrative, but carries a danger that it may lead to misunderstanding: the equipotential is not a solid surface in space and there is nothing to be in contact with. Whereas stars in a binary system can be in contact, a single star cannot really be in contact with a non-material surface.

The new name of "over-contact" seems to have originated through a logical step further, to describe the cases when the stellar surfaces are located outside the inner critical (or Roche lobe) surfaces. Here, I would like to argue, that – in such situations – the star either (slightly) over-fills its critical equipotential (and then is part of a semi-detached system) or forms a structure described by a common equipotential, effectively making it to be *in contact* with the other component.

I propose that the name contact binary be used to describe systems which fill the common equipotentials and form single bodies with two mass centres, and that the name over-contact be reserved for, so far undetected, cases of genuine overflow of the contact configurations. Such may exist, probably briefly, but their discovery would be of immense importance for our understanding of the the angular momentum loss evolution, which for many close binaries carries them through the successive stages of detached, semi-detached, contact binary systems and then – at the end, through a brief stage of over-contact – to single stars. In light of this more rigorous definition, a claim that we know over-contact systems is certainly an over-statement.

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