A STATISTICAL STUDY OF THE CORRELATION BETWEEN GALACTIC SNRS AND SPIRAL ARMS

Z.W. Li
Astronomy Department, Beijing Normal University, Beijing,China
J.C. Wheeler, F.N. Bash
University of Texas at Austin, USA

ABSTRACT. Based on the statistical studies of external galaxies, our Galaxy is expected to produce Type I and Type II supernovae in closely equal number. There are as of this writing 162 known galactic SNRs.

The basis for our investigation is the observations that SN II are tightly correlated with spiral galaxies and that SN I do not correlate with spiral arms, but are roughly of old disk population.

We seek a method by which a correlation of SNR with spiral arms can be determined. For this preliminary exercise we use only information on the positions of the SNR in galactic coordinates.

As a test, we compared the angular distribution of SNR and giant HII regions which are presumed to define the location of the spiral arms. To the eye, there did seem to have a correlation.

We thus faced a host of questions.

Do SN I still occur in spiral arms, implying that they have massive progenitors?

Is the rate of formation of SN I in Galaxy (and M31) considerably less than that of SN II?

Do SN I not produce long lived radio SNRs?

We have developed a quantitative approach to investigate these questions. Using the observed angular distributions of SNRs and giant HII region, we form a cumulative distribution with respect to angle. Two observed distributions can be compared then, and the Kolmogrov-Smirnov statistics was used to determine the probability that the two samples are not drawn from the same distribution.

In addition, we have constructed Monte-Carlo models in which sample objects are distributed in a prescribed pattern in the spiral arms and the galactic disk. The parameters of the Monte-Carlo simulation, such as the opening angle of the spiral arms and the fraction of objects in the disk vs arm population, can be adjusted to obtain the best fit to the observed distribution.

We also study the influence of the selection effects, if the surface brightness of SNR falls below a threshold for detectability (as $1/r^2$).

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