Theory of cosmic ray and gamma-ray production in the supernova remnant RX J0852.0-4622

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Abstract. **The properties of the Galactic supernova remnant (SNR) RX J0852.0-4622 (Vela Jr.) are theoretically analysed. An explicitly time-dependent, nonlinear kinetic model of cosmic ray (CR) acceleration in SNRs is used to describe the properties of Vela Jr., the accelerated CRs and the nonthermal emission. The source is assumed to be at a distance of 1 kpc in the wind bubble of a massive progenitor star. Also a rough estimate of the thermal X-ray flux in such a configuration is given, by using results calculated for a Sedov-phase SNR in a homogeneous medium. We find that the overall synchrotron spectrum of Vela Jr. as well as the filamentary structures in hard X-rays lead to an amplified magnetic field B ¿ 100 microG in the SNR interior. This implies that the leptonic very high energy (VHE) gamma-ray emission is suppressed, and that the VHE gamma-rays are hadronically dominated. The energy spectrum of protons produced over the life-time of the remnant until now may well reach "knee" energies. The derived gamma-ray morphology is consistent with the H.E.S.S. measurements. The amount of energy in energetic particles corresponds to about 35 percent of the hydrodynamic explosion energy. A remaining uncertainty concerns the thermal X-ray flux at 1 keV that in the above approximation comes out larger rather than smaller than the nonthermal flux at this energy. It is concluded that this SNR, expanding into the wind bubble of a massive star in a molecular cloud, can be a hadronic gamma-ray source that is consistent with all existing multi-wavelength constraints.**

Keywords**: Supernova remnant RX J0852.0-4622, particle acceleration, nonthermal emission**