Magnetic field evolution in interacting galaxies

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Violent gravitational interactions can change the morphologies of galaxies and, by means of merging, transform them into elliptical galaxies. We aim to investigate how they affect the evolution of galactic magnetic fields. We selected 16 systems of interacting galaxies and compared their radio emission and estimated magnetic field strengths with their star-forming activity, far-infrared emission, and the stage of tidal interaction. We find a general evolution of magnetic fields: for weak interactions the strength of magnetic field is almost constant (10-15muG) as interaction advances, then it increases up to 2x, peaks at the nuclear coalescence (25muG), and decreases again, down to 5-6muG, for the post-merger remnants. The magnetic field strength for whole galaxies is weakly affected by the star formation rate (SFR), while the dependence is higher for galactic centres. We show that the morphological distortions visible in the radio total and polarized emission do not depend statistically on the global or local SFRs, while they do increase with the advance of interaction. The constructed radio-far-infrared relations for interacting and non-interacting galaxies display a similar balance between the generation of cosmic rays, magnetic fields, and the production of the thermal energy and dust radiation. The process of strong gravitational interactions can efficiently magnetize the merger's surroundings, having a similar magnetizing effect on intergalactic medium as supernova explosions or galactic winds. If interacting galaxies generate some ultra-high energy cosmic rays (UHECRs), the disk or magnetized outflows can deflect them (up to 23 degrees), and make an association of the observed UHECRs with the sites of their origin very uncertain.

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