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The Mechanism for Energy Buildup in the Solar Corona[1] SPIRO ANTIOCHOS, NASA/GSFC, KALMAN KNIZHNIK, NRL, RICHARD DEVORE, NASA/GSFC — Magnetic reconnection and helicity conservation are two of the most important basic processes determining the structure and dynamics of laboratory and space plasmas. The most energetic dynamics in the solar system are the giant CMEs/flares that produce the most dangerous space weather at Earth, yet may also have been essential for the origin of life. The origin of these explosions is that the lowest-lying magnetic flux in the Sun's corona undergoes the continual buildup of stress and free energy that can be released only through explosive ejection. We perform MHD simulations of a coronal volume driven by quasi-random boundary flows designed to model the processes by which the solar interior drives the corona. Our simulations are uniquely accurate in preserving magnetic helicity. We show that even though small-scale stress is injected randomly throughout the corona, the net result of magnetic reconnection is a coherent stressing of the lowest-lying field lines. This highly counter-intuitive result – magnetic stress builds up locally rather than spreading out to a minimum energy state – is the fundamental mechanism responsible for the Sun's magnetic explosions. It is likely to be a mechanism that is ubiquitous throughout laboratory and space plasmas.

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Spiro Antiochos
NASA/GSFC

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