Stochastic Resonance could explain Recurrence of Grand Minima

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Proxies of solar activity have revealed repeated Grand Minima that occur with a certain regularity associated with the well-known Gleissberg and Süss/deVries cycles. These and other prominent cycles in the spectrum of solar activity are also seen in the spectrum of the planetary torque exerted on the solar tachocline, which has revived the hypothesis of a planetary influence on solar activity. It is not clear, however, how the extremely weak planetary forcing could influence the solar magnetic activity. Here, we suggest that stochastic resonance could explain the necessary amplification of the forcing and provide numerical evidence from stochastic time-delayed dynamo models. If the intrinsic noise of the solar dynamo allows for a frequent switching between active and quiescent stable states, tiny periodic forcings can be greatly amplified, provided the dynamo is poised close to a critical point. Such a forcing could be caused by a tidal modulation of the minimal magnetic field required for flux-tube buoyancy.