On the nature of seizure dynamics, Jirsa (2014), BRAIN

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- Two major seizure onset patterns: Fast discharges, spike and wave events(SWEs)
- Hypo:
  - dynamic properties invariant in most spontaneous and evoked seizures across brain regions & species
  - Invariant-->bifurcation(i.e. transition of states)
- Two building blocks('ensemble'):
  - Fast discharges: state variables(x_1,y_1)
  - SWEs: state variables(x_2,y_2)
  - Slow permittivity variable z: very low time scale, likely includes extracellular processes, influences the likelihood of seiz ure occurrence

- Note: Fast charges≠HFO!
- Taxonomy of SLEs
  - Mathematical basic: bursting
  - four types of bifurcations of equilibria(onset), four types of bifurcations of oscillations(offset)-->totally 16 classes
  - Predominant class: saddle-node(fold) bifurcation at onset and homoclinic bifurcation at offset-->fold/homoclinic class(square wave burster)
- The Epileptor Model
  - Hindmarsh and Rose (1984) for (x_1,y_1); Roy et al. (2011) for (x_2,y_2)
  - Some modifications
  - x_1+x_2 resembles field potential
- Dynamics: bistability
  - Separatrix: barrier between the two states
  - Stable fixed point<-->full circle
  - Unstable fixed point<-->empty circle
  - Towards seizure onset: separatrix collides with stable fixed point
- Predictions:
  - DC shift at seizure onset
  - Logarithmic scaling of interspike intervals approaching seizure offset
- Provoke seizures
  - External electrical stimulation
  - Timely internal noise