基于神经网络求解共振俘获的发生条件

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Outline

- Introduction
- Resonance Trapping
- Numerical Simulation
- Forbidden Mechanism in Spectroscopy

并行策略

- **程序最大运行时间限制**：每次模拟设置了最大运行时间 5min，超过时间的模拟将被终止。可能存在一些模拟未能完成的情况，此时检查模拟的最后几个时间步的数据。
- **采用进程级并行**：动力学模拟需要对微分方程进行数值积分，而数值积分通常具有强顺序性，本身难以并行计算。但是不同的初值之间没有关联性，可以很容易地实现并行。
- **部分初值下计算的严重超时问题**：在部分初值设定下，能有的恶魔你情况会因为积分器的精度设定出现时间步长过短的情况。其运行时间会大大超过之前的设置上限。这时如果不及时地停止该进程的计算，可能会导致这种计算彻底占满计算资源。此时应该设计一种方法及时终止该进程。
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Forbidden Mechanism in Spectroscopy

- **Definition:** A spectral line associated with photon absorption or emission by atomic nuclei, atoms, or molecules undergoing transitions not allowed by specific selection rules.
- **Allowed Transitions:**
  - Forbidden under usual approximations (e.g., electric dipole).
  - Allowed at higher approximation levels (e.g., magnetic dipole, electric quadrupole).
- **Transition Probabilities:**
  - Most forbidden transitions are relatively unlikely.
  - Meta-stable states have lifetimes on the order of ms to s.
  - Permitted transitions have lifetimes of less than $1\mu s$.
- **Astrophysical Forbidden Lines:**
  - Forbidden lines of nitrogen ([N II] at 654.8 and 658.4 nm), sulfur ([S II] at 671.6 and 673.1 nm), and oxygen ([O II] at 372.7 nm, [O III] at 495.9 and 500.7 nm) are observed in astrophysical plasmas.
  - The presence of [O I] and [S II] forbidden lines in T-Tauri star spectra indicates low gas density.