Irreversibility and complex spectral analysis of Liouvillian and Hamiltonian dynamics in terms of non-Hermitian operators

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General overview review of recent results of the complex spectral analysis of the Liouvillian dynamics as well as the Hamiltonian dynamics developed by Austin-Osaka group is presented. From the microscopic fundamental laws of physics, irreversible processes can be derived through the resonance singularities in the so-called small-denominator for the open systems without relying upon any phenomenological arguments such as the coarse graining approximation. Due to the resonance singularities, the Hermitian generator of motion in the Hilbert space leads to non-Hermitian effective Liouvillian and/or Hamiltonian with complex eigenvalues in the extended function space. These effective operators share the same eigenvalue with the original Liouvillian and/or Hamiltonian. The imaginary parts of the eigenvalues give the transport coefficients in irreversible processes. In this talk the irreversible process associated with the Jordan block that has no counter part in Hermitian dynamics will be discussed.