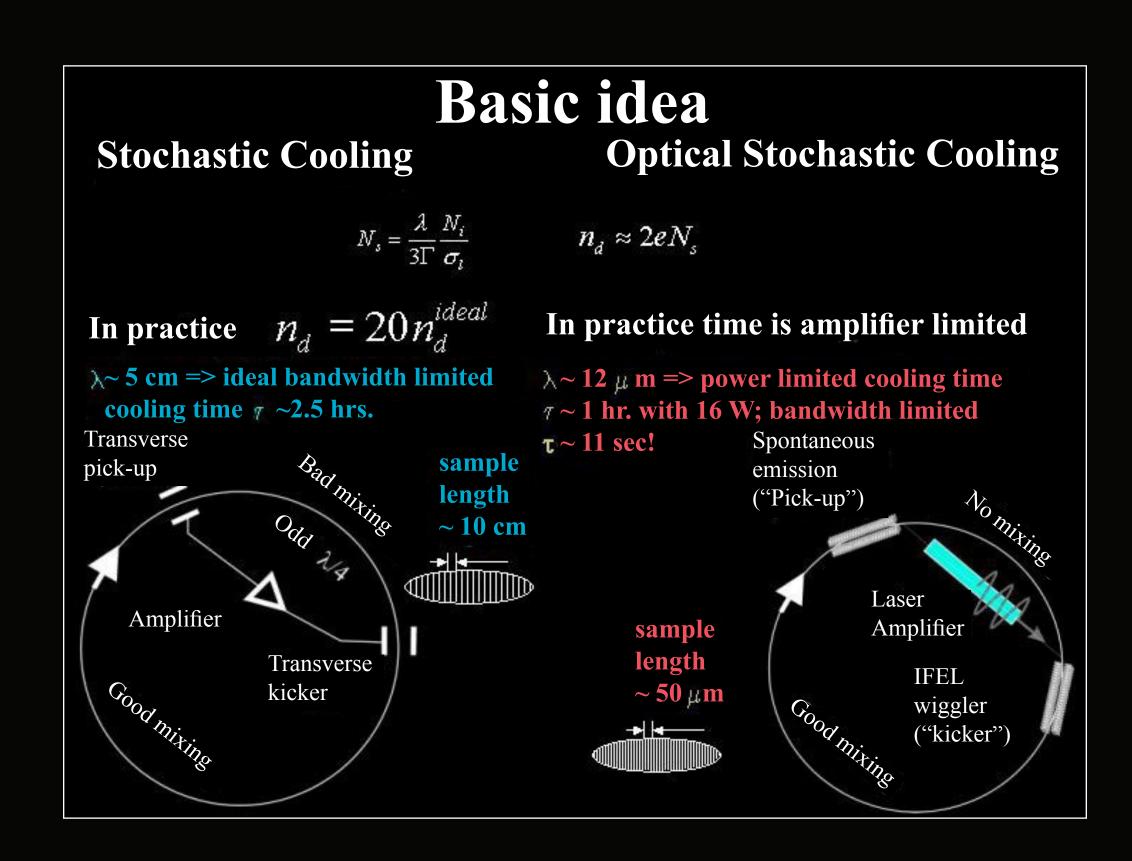
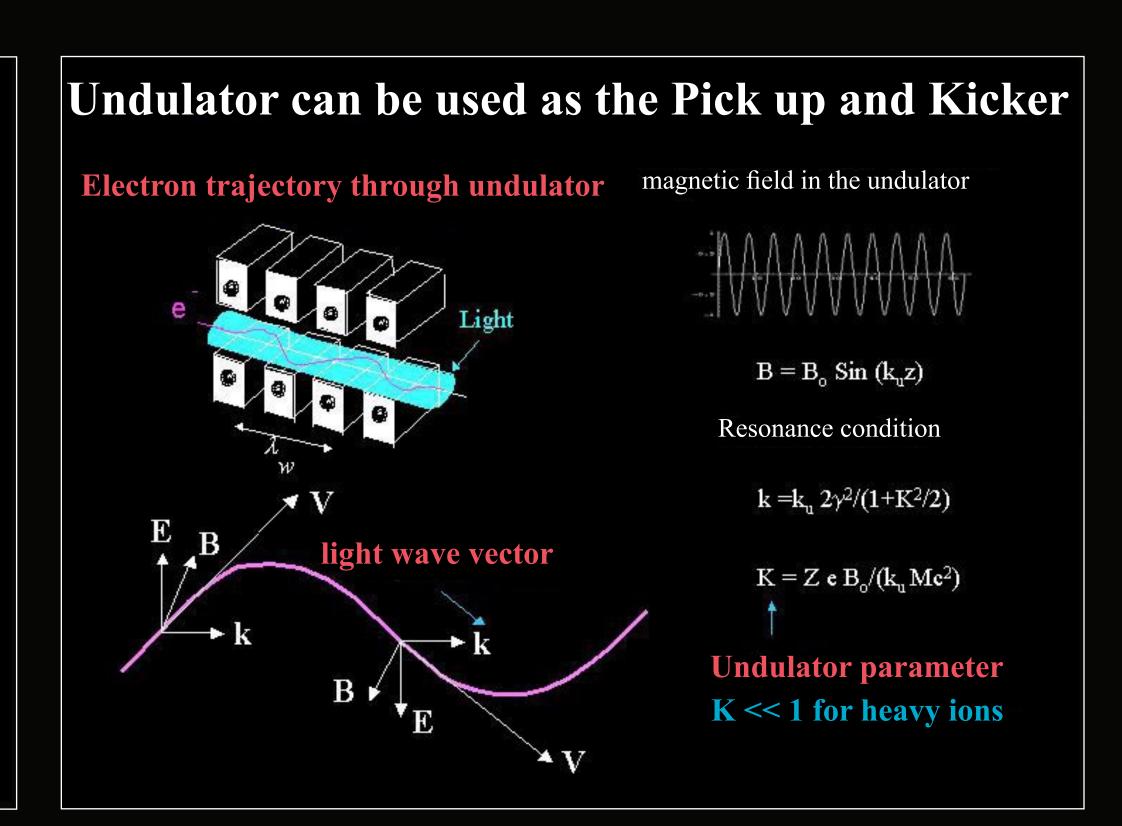
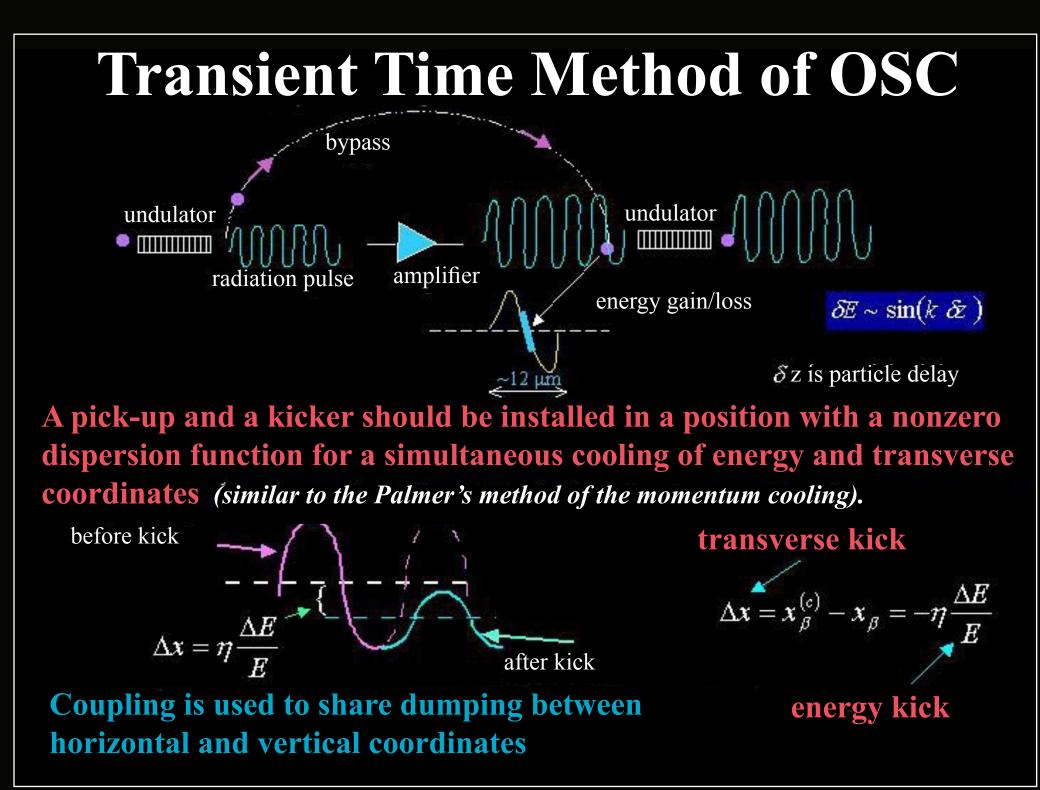
Optical Stochastic Cooling for RHIC



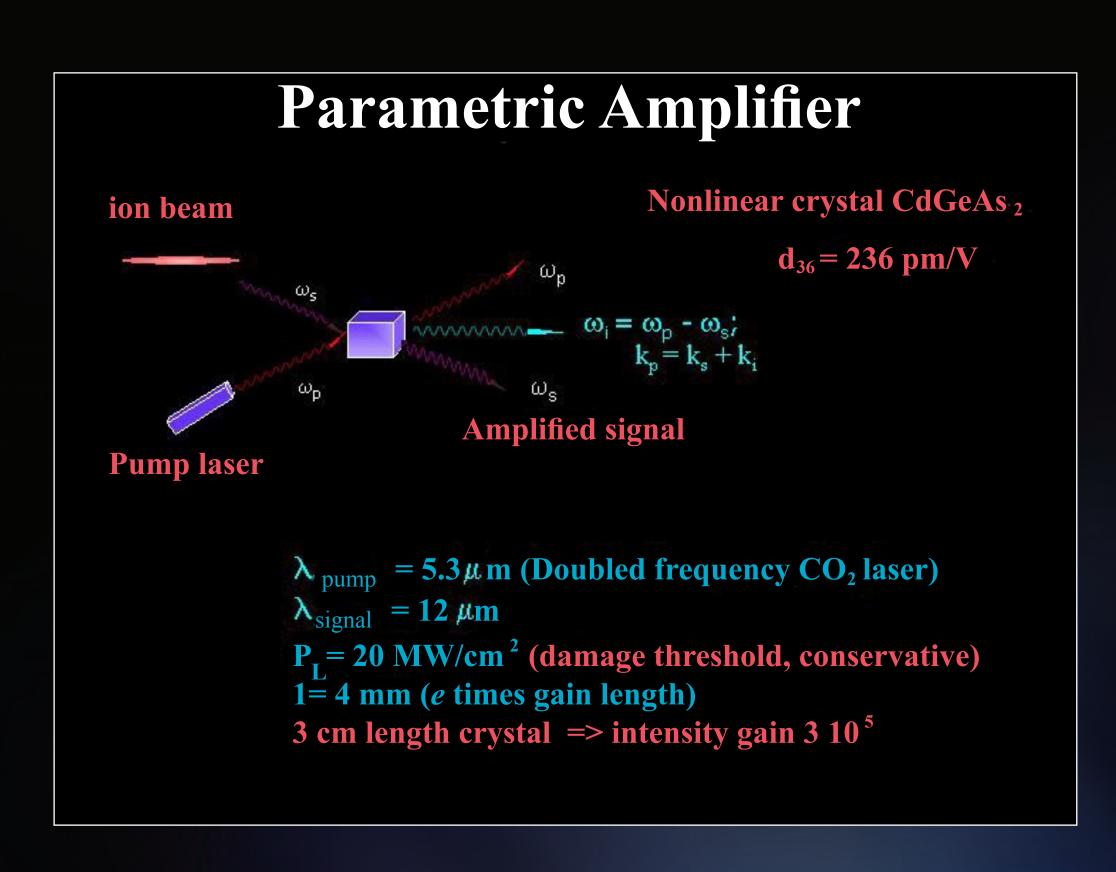
5 main components of OSC

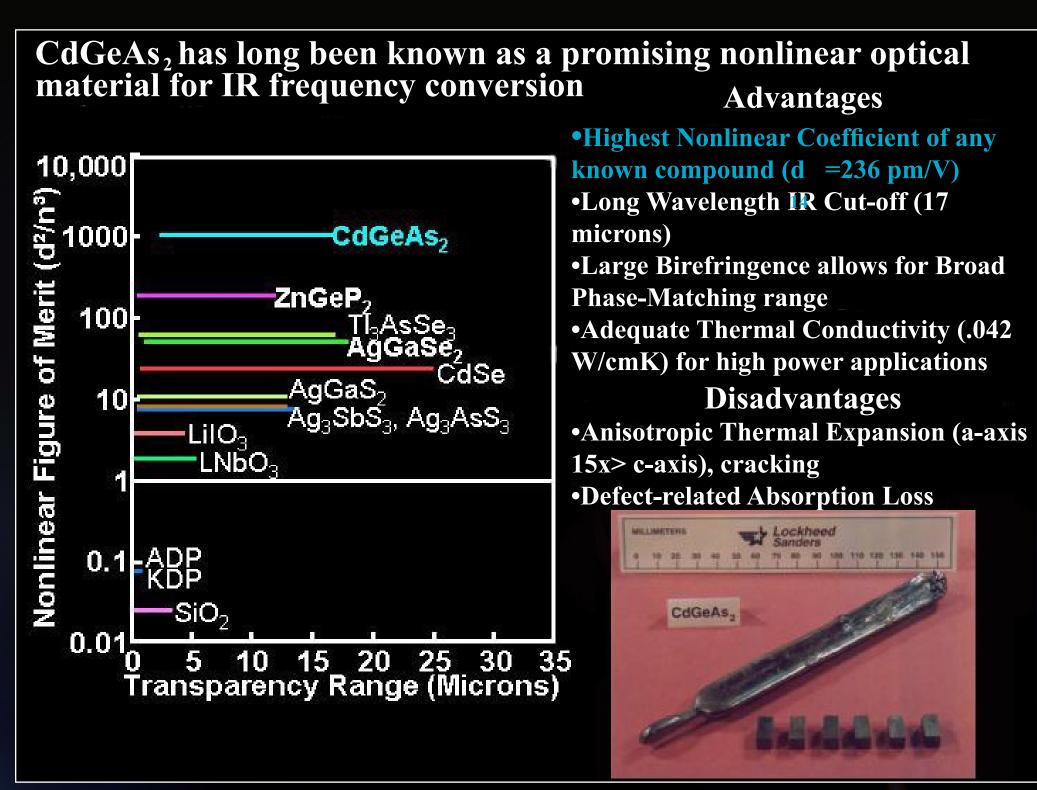
- Optical amplifier (Optical Parametric Amplifier (OPA): 3 cm long CdGeAs2 crystal, cooled to 77K for better thermal conductivity and transparency) (experimental tests within 1 year)
- Pump source for OPA (mode locked CO or CO-2 laser operating at 10 MHz with 200W output at 5.3 micron) (forgotten technology, design with 1 year)
- RHIC lattice modification design (exist only understanding what needs to be done)
- Diagnostics (needs to be developed)
- Pair (per ring) of 10T 3 meter long wiggler and modified RHIC bending magnets (to allow wiggler light extraction) (existing technology, need cost estimate)

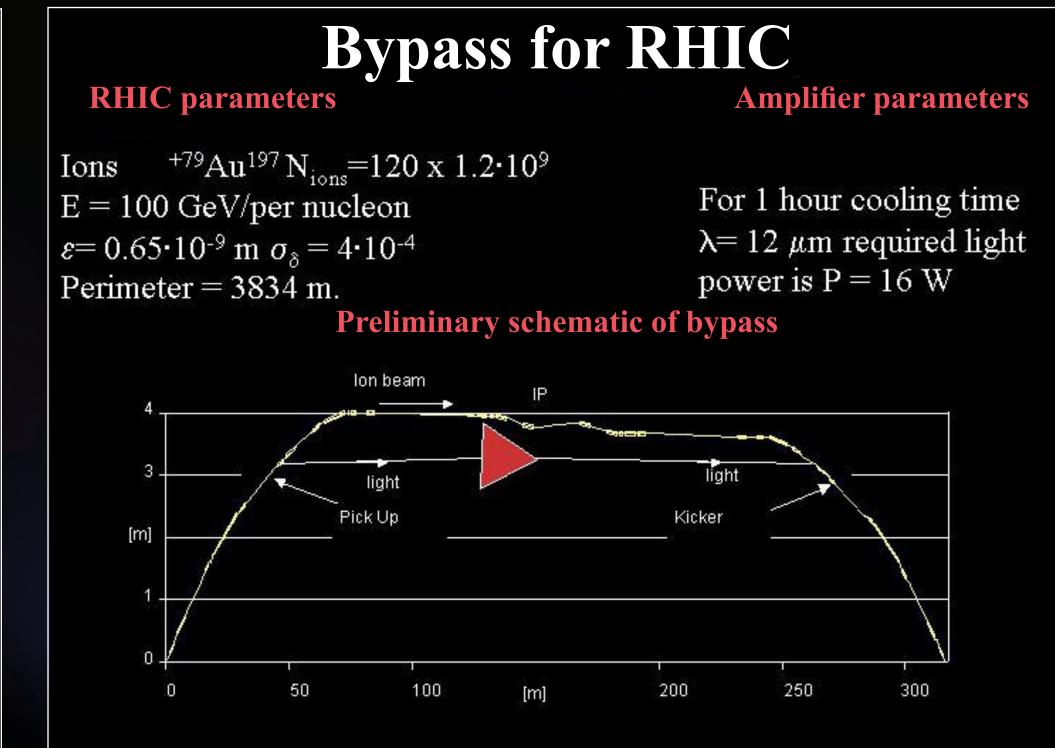




Making sense of the different







cooling techniques Stochastic Cooling: beam error Optical SC: Same as SC, but at optical wavelength signal is measured by a pickup, • Not limited by amplifier bandwidth ~ 3 THz amplified by RF amplifier and • Can cool whole RHIC beam in one hour with corrected in the kicker 16W of optical power • Experiment on RHIC-Spring 2004 • Favors large amplitudes, can be adjusted for the • Works over wide range of ion different beam amplitudes • Greatly reduces requirements on electron beam energies • Limited by amplifier bandwidth current if used with EC • Works over limited ~5-10% range of the ion beam • Requires expensive RF amplifier energies Possibly can cool only trails of the Requires challenging RHIC lattice modifications No experimental demonstration - period. Electron cooling: ion beam "heat" transferred to "cold" electron beam • Limited by electron beam current Works over wide range of the ion beam energies Effective for the beam core and against IBS (faster cooling for the colder beam) • Complimentary with OSC as it effective against IBS (main growth in RHIC) Requires expensive and challenging ERL and long solenoid

(Colors: Good, Bad)

•EC was not demonstrated at high energies

Neither cooling was demonstrated for the bunched beam

