

# Discussion of Radiation

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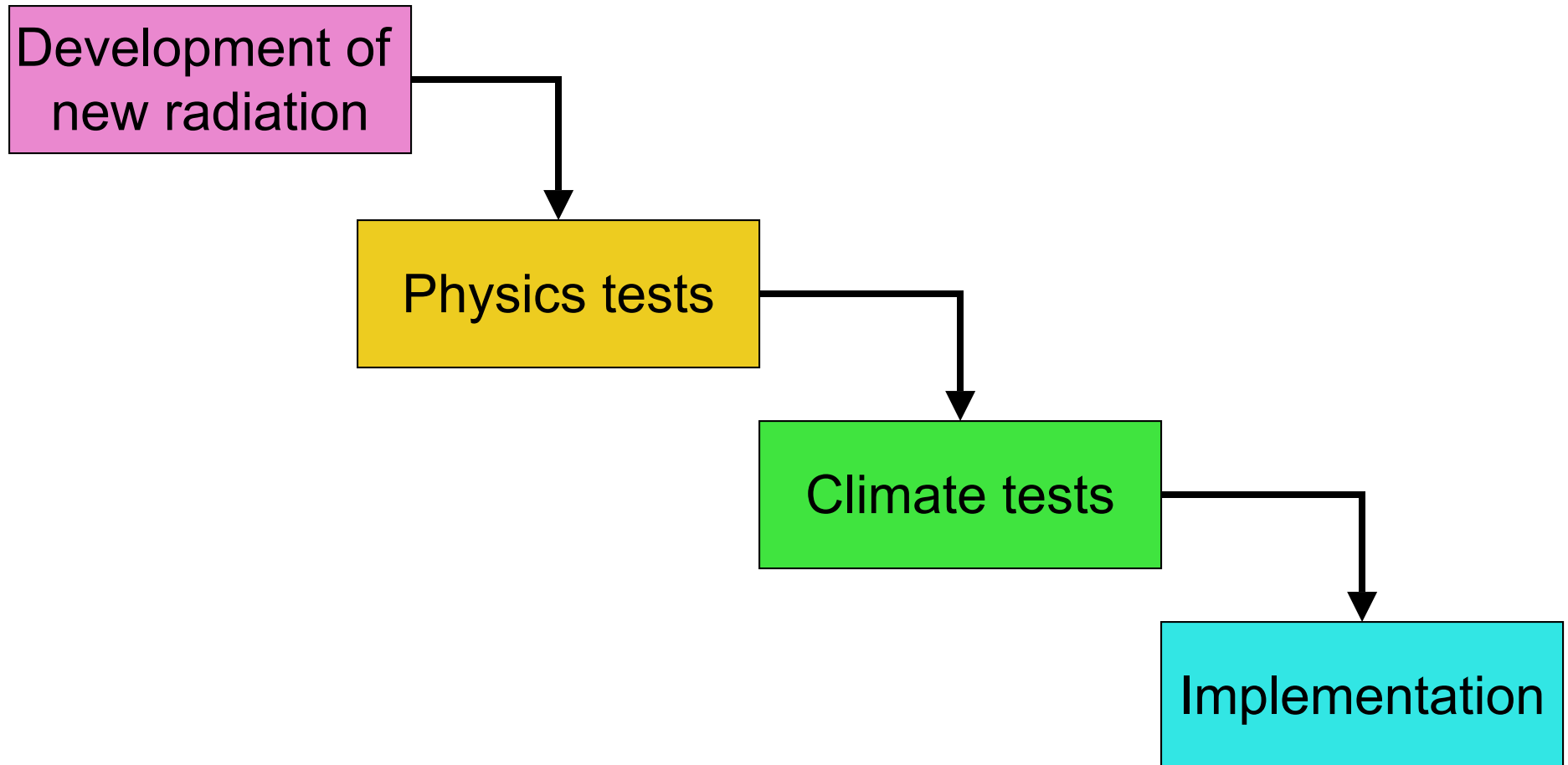
*UC Berkeley and LBL*

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# Requirements for new radiation?

- Advantages of new RRTM method:
  - **Modern optical properties of gases**
  - **Traceability to line-by-line reference codes**
  - **Extensibility to new radiative species / optics**
  - **Extensibility to arbitrary cloud overlap**
  - **Comprehensive validation against ARM data**
- Accuracy?
  - **Our standard:  $\geq$  CAM radiation package**
- Speed?
  - **Requirements?**

# Steps toward new radiation



# Physics Tests of RRTM

*versus reference calculations*

- Comparison against community benchmarks
  - Gases (*Phase 1*):
    - ✓ GHGs: RTMIP
    - ✓ H<sub>2</sub>O: RTMIP
    - Ozone: TBD
  - Condensed species (*Phases 2 and 3*):
    - Aerosols: Necessary? Primarily a test of RT solver.
    - Clouds: Necessary? Primarily a test of RT solver.

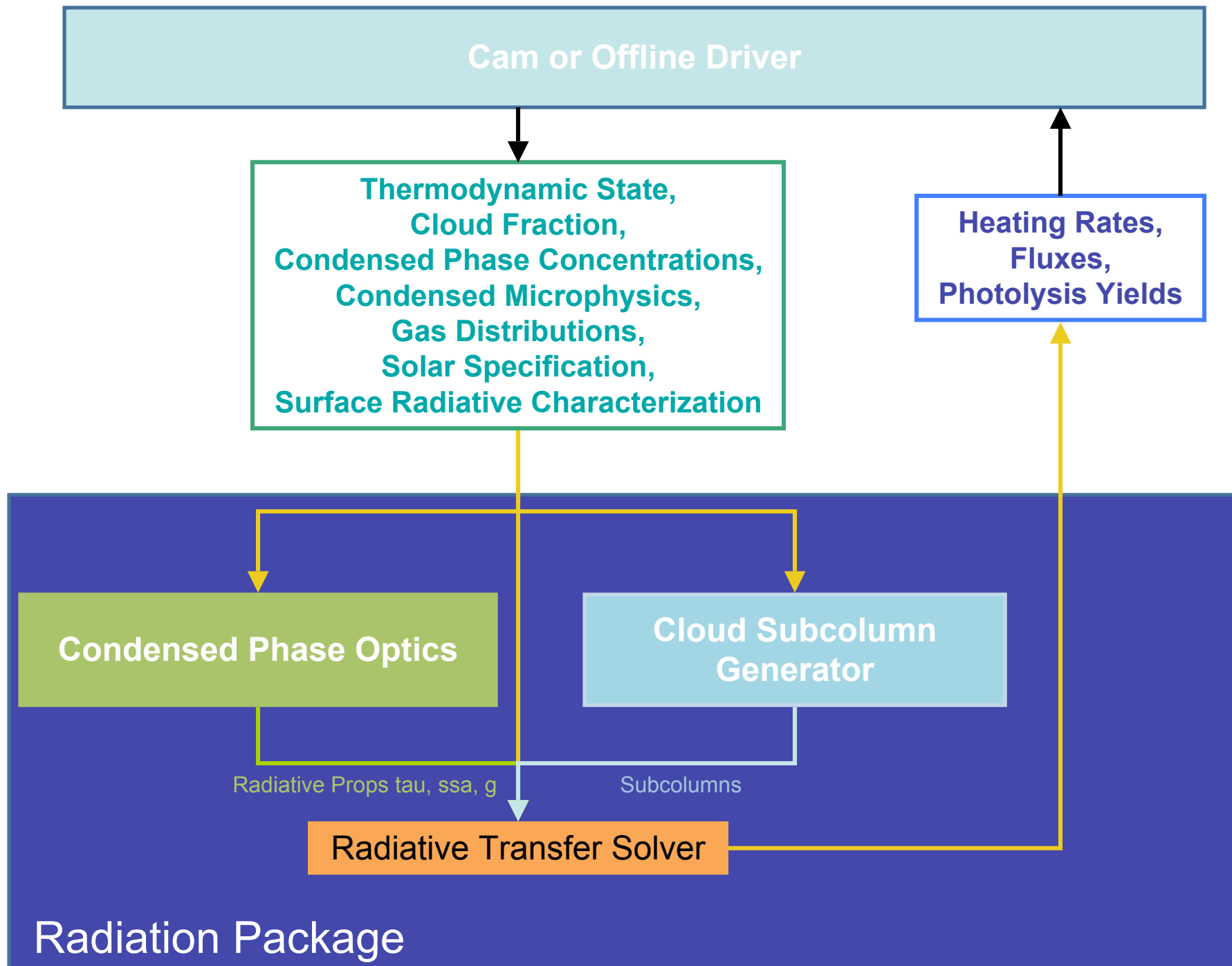
# Climate tests of RRTM

*versus current CAM radiative code*

- Tests with new scheme in interactive mode:
  - **Result: Large cloud radiative effect differences: why?**
  - **Explanations under investigation:**
    - Differences in mapping water-vapor / cloud optics in near-IR
    - Differences in cloud-column generators
    - Differences in vertical cloud structure
- Tests with new scheme in diagnostic mode:
  - **Now underway, using column radiation model**

# Implementation

- Radiation interface -- well underway
  - ✓ Initialization phase: done
  - Run phase: mostly done, but
    - Forcing calculations written but untested
    - Microphysical parameter interface TBD
    - Sharing of column generator with other physics TBD
  - Finalize phase: mostly done, but
    - Archival of radiation input fields for offline calculations TBD
    - Namespace conflicts for diagnostic output to be solved



# Open issue #1: Clouds

- Liquid-cloud optics:
  - ✓ Target: Morrison-Gettelman microphysics
  - ✓ Specs for calculation determined.
- Ice-cloud optics:
  - ✓ Target: Mitchell cirrus AD optics
  - ✓ Specs for calculation determined.

# Open issue #2: Aerosols

- What are the target species?
- What are the target optics?
- Procedure for integration with RRTM?