Approach for Version 1.0

A brief document

Evolution

Harold Urey
(1893 – 1981)
Sources of Input for Version 1.0

Experience – literature
Recent meetings – SBAG, DPS, LAW, etc.
Colleagues’ conversations
Recent white papers
Survey of workers
Outline for Version 1.0

Introduction
General issues – state of the art
Properties and processes
Spectroscopy and chemistry
New techniques, goals, subjects
Sample-return issues (see others)
Infrastructure – support
Introduction

Provide data, simulations, numbers for computational models, and answers to fundamental questions

Make predictions ↔ “Calibrate” lab work

Help guide ground- and space-based campaigns

Help define science goals, mission goals

Assist with flight-instrument tests

Storage and analyses of returned samples

Outline
An Example - Comets

Dina Prialnik et al. (2004) in Comets II
Outline

Introduction

General issues – state of the art

Earth-sciences data

Earth-sciences database

Spectroscopy, chemistry, and the ISM

Chemical kinetics

UHV conditions
Outline

Introduction

General issues – state of the art

Properties and processes

Ices, minerals, mixtures
Examples – density, thermal conductance, electro-magnetic, wetting, sticking, tensile strength

Brines & slurries – viscosities, geochemical kinetics

Phase diagrams – mixtures – P & T
Extrapolations

$\sim 1 \text{ cm} \times 10^{-4} \text{ cm}$

$10^5 \text{ cm}$

(1 mile)
Outline

Introduction

General issues – state of the art

Properties and processes

Rates - kinetics

Isotopic changes?

Enclathration rates and efficiencies

Fracture physics

Diffusion of ice through rocks, minerals
Low-Gravity Studies

Convection          Differentiation

Reactions

Lab results      SYNERGY      Theory
Outline

Introduction
General issues – state of the art
Properties and processes
Spectroscopy and chemistry
Some Lab Spectroscopy Needs

Solids – spectra, optical constants

Non-H$_2$O Ices
CH$_4$, N$_2$, …

Rocks, minerals, mixtures, and clathrates
Introduction

General issues – state of the art

Properties and processes

Spectroscopy and chemistry
Some Lab Chemistry Needs

Solids – Reaction chemistry – Ices

Simple & complex molecules

Thermal
Radiolytic
Photolytic

Rocks, minerals, mixtures, and clathrates
Equipment Intensive
Space-Weathered Materials

Solar Wind

Mag >> Cosmic Rays

Galactic Cosmic Rays

Pluto

Comets

Mag >> Cosmic

Mag << Cosmic

UHV
Water Ice on Asteroid
Exogenous or Endogenous?

24 Themis
Rivkin & Emery (2010)

Lab measurements of well-characterized analogs can aid in compositional studies.
Some Lab Spectroscopy Needs - Gases

Gases – absolute intensities, line assignments

Want ability to model spectra at various T’s

IR spectra of ions

Isotopic ratios – ice vs. gas

Ortho-para issues
Outline

Introduction

General issues – state of the art

Properties and processes

Spectroscopy and chemistry

New techniques, goals, subjects
New Techniques, Goals, Subjects

Large-scale methods (> 10 cm)
Sampling technology (e.g., fluffies)
New spectral methods – remote
New spectral methods – in situ

Astrobiology – biotic vs. abiotic
Avoid false positives
How are “ee” values altered?
Outline

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Sample-return – see others
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More issues – infrastructure – support
Infrastructure and Support

Large-scale facilities rare
User facilities are rare
Lack of coordination among lab workers
Electronic databases
Ex / Radar measurements, dielectric constants

NAS-NRC 2010 report on NASA laboratories

Succession and continuity
Example – Continuity

Photochemical Lifetimes & Gas-Phase Kinetics

Come Hale-Bopp  
ca. 1996

D  R  $$  A+  R
Looking Ahead

Additional community input
AAS lab group (WGLA)
Meeting sessions (DPS, etc.)
Your questions and comments

Version 2.0 – August 2011 SBAG Meeting
Outline

Introduction
General issues – state of the art
Properties and processes
Spectroscopy and chemistry
New techniques, goals, subjects
Sample-return – see others
More issues – infrastructure – support
The End