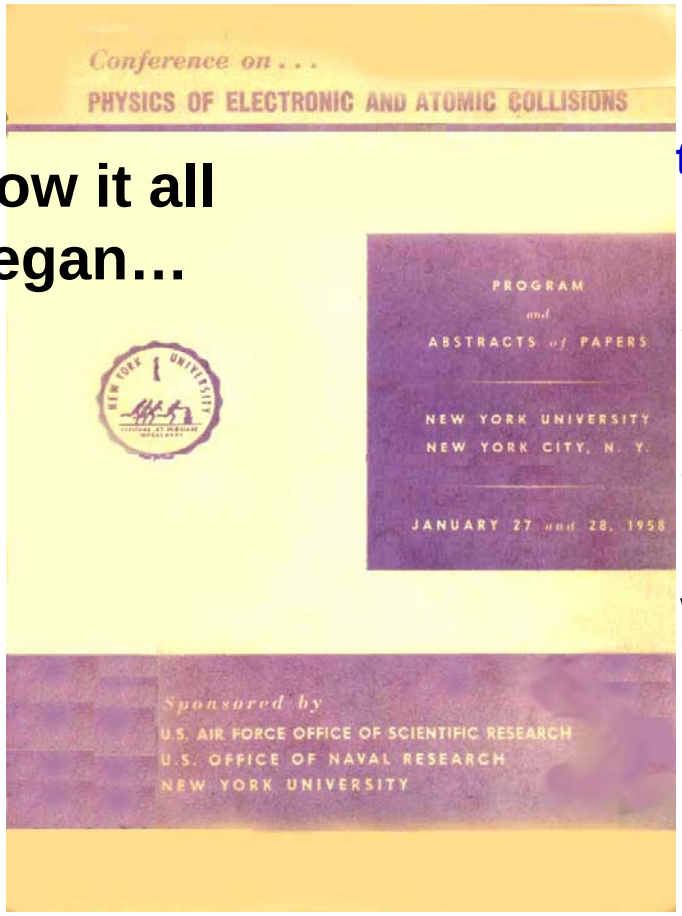
50 years of ICPEAC: a brief introduction

Joachim Burgdörfer

July 22, 2009

Inst. For Theoretical Physics, Vienna UT
http://dollywood.itp.tuwien.ac.at

How it all began…



the organizing comittee

I. Amdur
S. Borowitz
B. Bederson (chair)
L. Branscomb
S. Geltman
F. Smith
E. Beaty
W. Fite

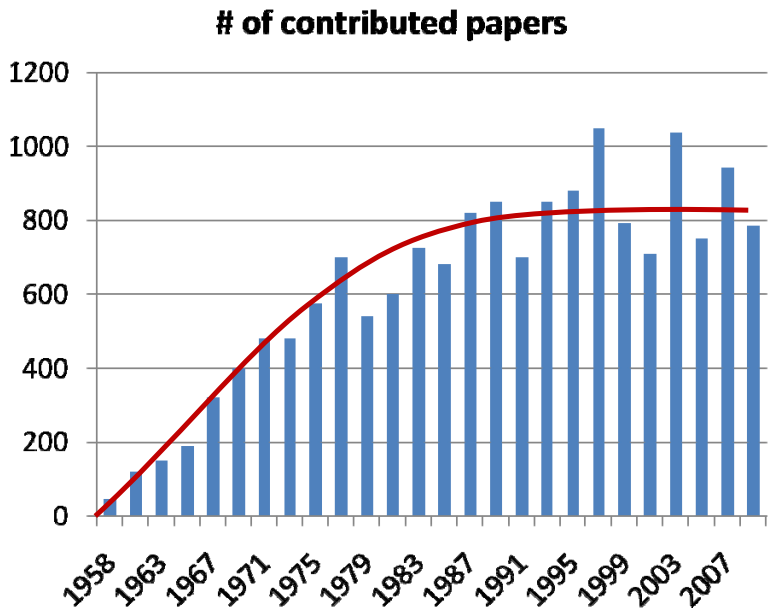
"This conference is the second in the series of informal meetings organized by a group of works in the general field of electronic and atomic collisions. The first such meeting was held at New York University in 1958, and we will probably continue to meet at irregular intervals in the future"

Benjamin Bederson, Preface, Book of Abstracts, ICPEAC II, 1961

…among the early participants and (co-)authors

B. Bederson
L.M. Branscomb
P.G. Burke
E. Condon
G.H. Dunn
A. Dalgarno
H. Ehrhardt
U. Fano
J.D. Garcia
E. Gerjuoy
J.B. Hasted
D. Hershbach
H.P. Kelly
J. Kistemaker
W.E. Lamb
L. Lederman
J. Lindhard
B. Lippman
D.C. Lorents
Sir H. Massey
M.R.C. McDowell
P.M. Morse
J. Ross
M.E. Rudd
M. Seaton
A. Temkin
P. Toschek

Growth of the Conference



"*In its present form one might expect an asymptote of 900-1000 contributed papers*"

S. Datz, ICPEAC XVI keynote address, 1989

among notable contributions…

D8

FORMATION OF MUONIUM*

V. W. Hughes, A. Lurio,† D. P. Malone and D. McColm

Yale University

and

L. Lederman and M. Weinrich

Columbia University

The production of polarized μ^+ mesons from π^+ decays and the angular asymmetry in the distribution of e^+ from μ^+ decays, which are associated with parity non-conservation, may make possible studies of the energy levels of the bound state of μ^+ meson and an electron (muonium).[1, 2]

abstract at ICPEAC I, 1958

Nobel prize in physics 1988

"for the neutrino beam method and the demonstration of the doublet structure of the leptons through the discovery of the muon neutrino"

crossed molecular beam chemistry

abstracts at ICPEAC II, 1961

F2 THE REACTIVE SCATTERING OF VELOCITY SELECTED K ATOMS BY HBr.

D. BECK, E. F. GREENE, and J. ROSS

Metcalf Chemical Laboratories, Brown University
Providence, Rhode Island

F3 REACTIVE SCATTERING IN CROSSED MOLECULAR BEAMS*

G. H. KWEI, J. A. NORRIS, J. L. KINSEY,† and D. R. HERSCHBACH

Department of Chemistry and Lawrence Radiation Laboratory, University of California, Berkeley, California.

Several recent crossed beam experiments are reviewed in which the angular distribution of reactively scattered alkali halide has been measured in reactions of the type $M + RX \rightarrow R + MX$. Kinematical features[1] of the reactions of K, Rb, and Cs with CH_3I are particularly favorable for a study of the recoil spectrum of the product molecules, and an analysis of the data which relies only upon conservation laws has shown: (1) the final relative velocity vector v' has a quite anisotropic distribution, peaked about the direction of the initial relative velocity vector v; (2) over 80% of

Nobel prize in chemistry 1986

"for contributions concerning the dynamics of chemical elementary processes"

first discussion of “Cooper” minima

abstracts at ICPEAC II, 1961

A4 OSCILLATOR STRENGTH DISTRIBUTION OF RARE GAS ATOMS CALCULATED IN A CENTRAL POTENTIAL MODEL

J. W. COOPER

National Bureau of Standards, Washington, D.C.

Calculations of the photoionization spectral distribution and the distribution of discrete optical oscillator strengths of neon, argon, and krypton have been performed assuming a central field model in which one optical electron moves in the same central potential in both initial and final states. The potential used was obtained from published Hartree-Fock ground state wave functions for each atom.[1]

A5 ON A QUALITATIVE FEATURE OF PHOTOIONIZATION SPECTRA

U. FANO

National Bureau of Standards, Washington, D.C.

The photoionization spectrum of an electron in any bound state of a coulomb field decreases monotonically in the direction of high frequencies. Cooper's results (see preceding abstract) for an electron in potential wells similar to those of rare gas atoms show: a) for Ne a spectrum that differs from that of H only by an (understandable) initial rise, and b) for A and Kr a radically different spectrum with an initial sharp drop followed by a sec-

Ugo Fano

Fano symposium 1987

75th birthday celebration of Ugo Fano at ICPEAC XV in Brighton 1987

(…dephasing) collisions of "free atoms stored in a box"

K3 STUDY OF ATOMIC COLLISIONS BY RESONANCE TECHNIQUES

HOWARD BERG

Harvard University*

The effects of wall collisions on the hyperfine frequency of cesium and hydrogen have been studied in resonance experiments with free atoms stored in a box. In one series of experiments, the atomic beam separated oscillatory field resonance technique was used to study the hyperfine frequency of cesium perturbed by collisions with storage box walls. This led to the use of the storage box technique with hydrogen in an atomic beam maser. The hydrogen maser promises to be a useful tool for the study of atomic collisions. The cesium results will be described briefly, and some remarks will be made regarding the hydrogen maser.

*The work reported here was carried out by H. Mark Goldenberg, Daniel Kleppner, and Norman F. Ramsey.

abstract at ICPEAC II, 1961

Biological Physics Prize of the American Physical Society with Edward Purcell in 1984

early adventures in computational physics

abstract at ICPEAC I, 1958

A5

A NUMERICAL METHOD OF SOLUTION OF SOME EQUATIONS OF SCATTERING THEORY

P. A. Fraser

Department of Physics, University of Western Ontario
London, Canada

….with the general availability of high-speed and large – capacity electronic computers, the arithmetic problem is no great difficulty….

early adventures in computational physics

abstracts at ICPEAC II, 1961

11 CALCULATION OF ELASTIC s-WAVE ELECTRON SCATTERING FROM HYDROGEN*

C. SCHWARTZ

Department of Physics, University of California, Berkeley, California

The Kohn-Hulthén variational principle for $\lambda = k^{-1} \tan \delta$,

$$\lambda = \lambda_t + \frac{2m}{\hbar^2} \int \psi_t (E - H) \psi_t ,$$

"We have come to understand that due to the continuum spectrum in the scattering domain, the result of any particular variational calculation can be arbitrary far from the correct answer"

12 SCATTERING OF ELECTRONS BY ATOMIC HYDROGEN*

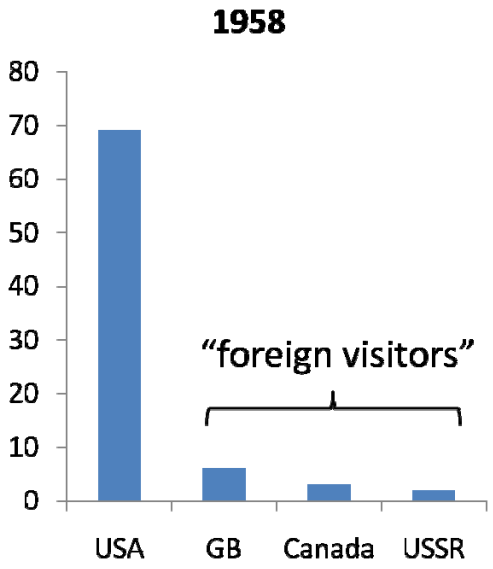
P. G. BURKE
Lawrence Radiation Laboratory, University of California, Berkeley, California.

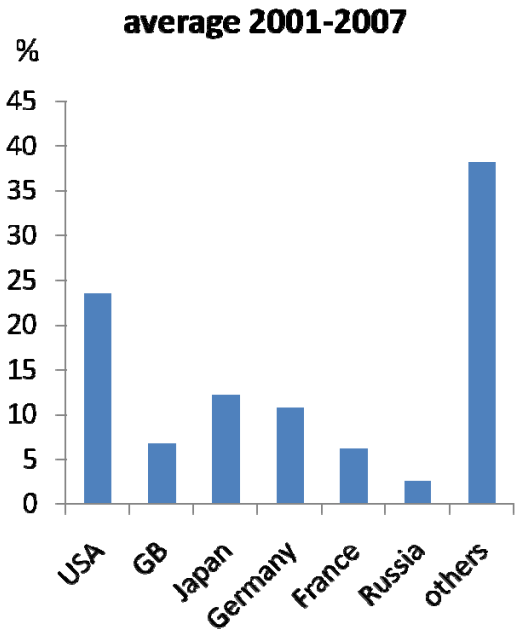
V. M. BURKE
Physics Department, University of California, Berkeley, California.

H. M. SCHEY
Lawrence Radiation Laboratory, University of California, Livermore, California.

"In principle the code can deal with any number of coupled equations, however, because of space limitations in the computer and numerical difficulty in the calculation this number is limited in practice"

From a National to an International Conference:





Evolution of ICPEAC acronym

*1958: **C**onference on the **P**hysics of **E**lectronic and **A**tomic **C**ollisions (CPEAC)*

*1961: International **C**onference of the **P**hysics of **E**lectronic and **A**tomic **C**ollisions (**I**CPEAC)*

*2001: **I**nternational **C**onference on the Physics of Photonic, **E**lectronic, and **A**tomic **C**ollisions (ICPEAC)*

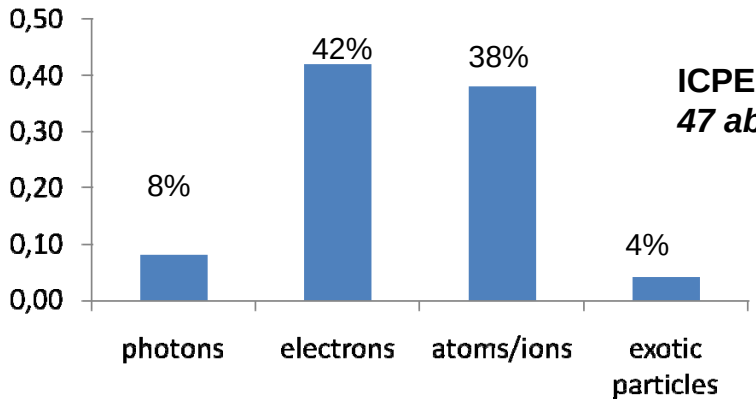
Evolution of topics

"*The subject matter would include the elastic and inelastic collisions of electrons plus and minus with atomic and simple molecular systems, photodetachment, charge exchange processes etc. It would exclude multiple processes, solid state problems and exclusively bound state problems*"

Report of the program meeting, April 26th 1957

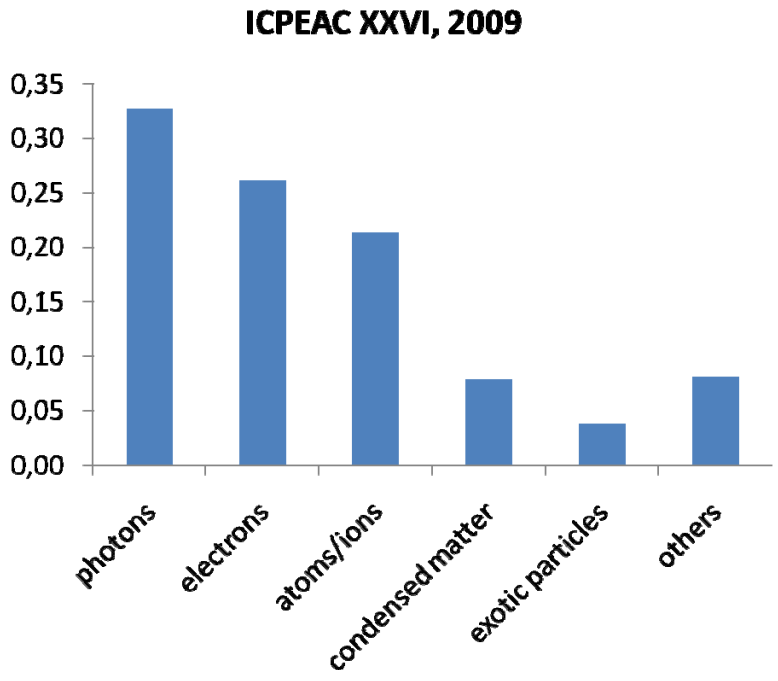
"*Collective phenomena, applications, and work which has not yet yield results will be mercilessly excluded*"

Memorandum to steering committee members, 1964



ICPEAC I, 1958:
47 abstracts

the distribution has changed…



solids and collective effect appear …

A6 PHOTO-EXCITATION OF ATOMIC SYSTEMS AND THE ENERGY LOSS BY MOVING CHARGED PARTICLES

WERNER BRANDT
Department of Physics, New York University

JENS LINDHARD
Department of Physics, Aarhus University

MORTEN SCHARFF
Institute for Theoretical Physics, University of Copenhagen

I

The photo absorption cross section, $\tau_Z(w)$, of atoms of atomic number Z is related to the differential oscillator strength distribution $g_Z(w)$ as $\tau_Z = (2\pi^2e^2/m)g_Z$. By the sum rule, $\int_0^\infty g_Z(w)dw = Z$. The properties of g_Z vary with frequency range. At frequencies $(w/Zry) \lesssim Z^{-1}$, the absorption spectrum is essentially a line spectrum, and g_Z has the approximate form $\sum f_Z(w_i)\,\delta(w - w_i)$, where $f_Z(w_i)$ is the oscillator strength associated with

abstract at ICPEAC II, 1961

Towards more complex processes

- energy loss and charge state equilibrium in solids, ICPEAC II, 1961
- collisions involving clusters, ICPEAC XIV,1985
- surface and condensed matter collisions, ICPEAC XV, 1987

the conference format evolves:

- ICPEAC VII, 1971: first book of invited papers
- ICPEAC IX, 1975 : first poster session
- ICPEAC XXIII, 2003: electronic submission of abstracts
- ICPEAC XXV, 2007: open-access online publication of proceedings
- ICPEAC XXVI, 2009: open-access online publication of abstracts

ICPEAC VII (1971): still fits on conference photo

Unique features

“Democratically organized” conference

International organization with a representative governing body

International officers:
chair, vice-chair, former chair, secretary, treasurer

Executive committee:
+ former, present and future local chairs

40-member general committee representing the participants

“Participants vote with their airline tickets and contributed papers”
Sheldon Datz, keynote address, 1989

(International) Chairs

1958: Benjamin Bederson
1961: Benjamin Bederson
1963: Benjamin Bederson
1965: Wade Fite
1967: L. Artsimovich
1969: Nicolai Fedorenko
1971: Lewis Branscomb
1973: Helmut Erhardt
1975: Phil Burke
1977: Felix Smith
1979: Jaap Kistemaker
1981: Ronald.F. Stebbings
1983: Frank H. Read
1985: Benjamin Bederson
1987: Werner Mehlhorn
1989: Eugen Merzbacher
1991: Franco A. Gianturco
1993: Sheldon Datz
1995: François Wuilleumier
1997: Gordon Dunn
1999: Hartmut Hotop
2001: Max Standage
2003: Kate Kirby
2005: Albert Crowe
2007: Yasunori Yamazaki
2009: Joachim Burgdörfer

ICPEAC officers in action

Banquet at ICPEAC XXI in Sendai 1999

.. a few more

Unique schedule

Wednesday to Tuesday

WE | THU | FR

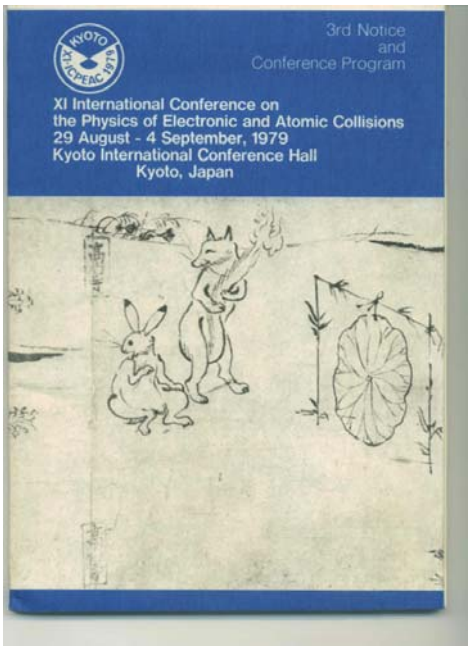
MO | TU

break for relaxing, networking, …

Traditions

The Daily Newsletter

ICPEAC informal



Sheldon Datz Prize (since 2005)

"The award of the Sheldon Datz Prize supports the attendance of an **outstanding young scientist** (graduate student, post-doc). Among equally qualified candidates, the personal/institutional funding situation that would otherwise not enable participation of the applicant at ICPEAC is taken into account."

1967

1999

Prize winners:

- 2005: Michael Bromley (Darwin University, Northern Territory)
- 2007: Vandama Sharma (Department of Space,Navrangpura,India)
- 2009: Juan Randazza (Bariloche, Argentina)

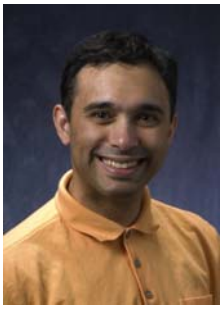
IUPAP Prize (since 2007)

"The prize is awarded for an outstanding young scientist in the field of Atomic, Molecular and Optical Physics"

awarded alternately at ICPEAC and ICAP

Prize winners:

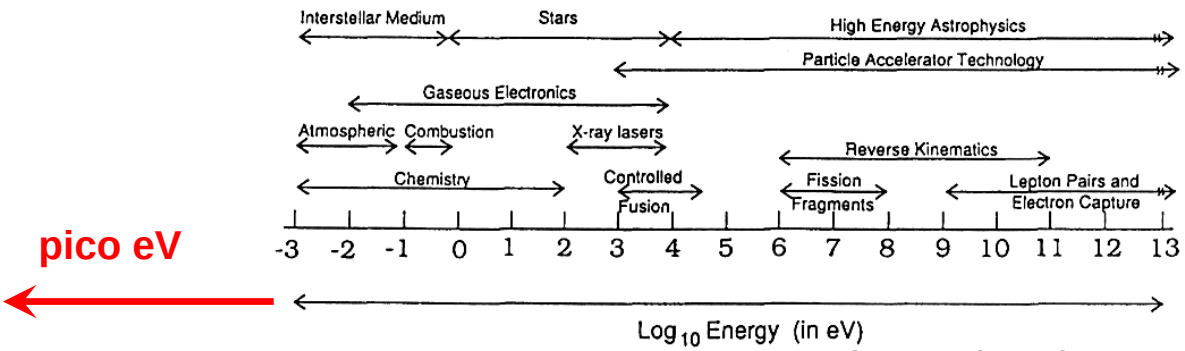
- 2007: Robin Santra (Argonne National Laboratory)
- 2008: Cheng Chin (University of Chicago)
- 2009: Johan Mauritsson (Lund University)



Contributed papers: cutting-edge developments

- laser assisted collisions, ICPEAC VI, 1969
- multi-photon processes, ICPEAC IX, 1975
- photoionization by synchrotron radiation, ICPEAC XI, 1979
- electron beam ion source (EBIS), ICPEAC XII, 1981
- COLTRIMS ("the reaction microscope"), ICPEAC XVII, 1991

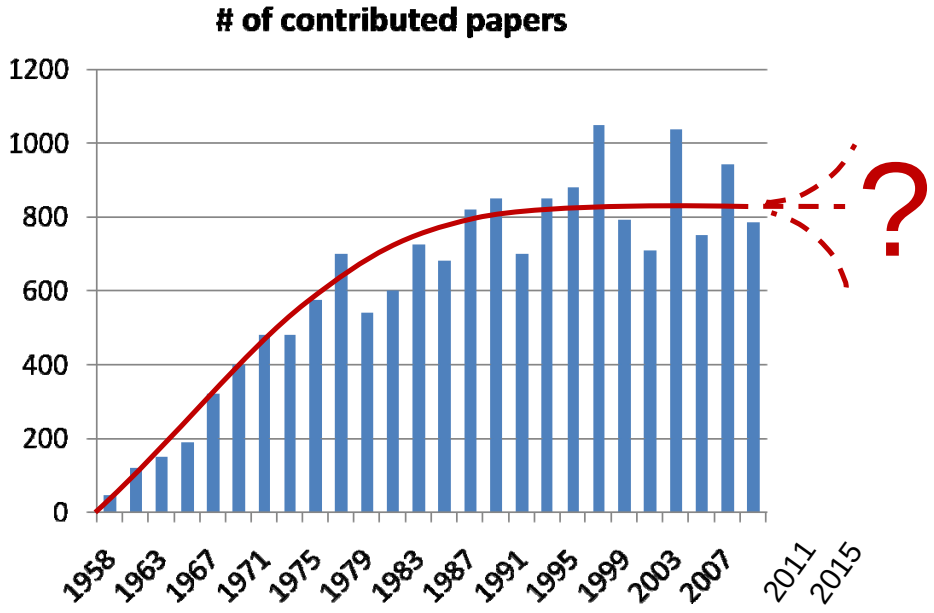
Exploring a wide range of energies



S. Datz, ICPEAC XVI

- Symposium on cold collisions, ICPEAC XVI,1989
- BEC, ICPEAC XX, 1997

Future growth of the conference



Expect the unexpected !