

## **Energy Loss of Heavy and Light Ions**

### **Threshold behavior and isotope effect in low-energy electronic stopping of light ions**

A. Schinner, V. Shulga, P. Sigmund. *J. Appl. Phys.* **129** (2021) 185304

### **Effect of impact-parameter-dependent electronic energy loss on reflected-ion spectra**

V. I. Shulga, A. Schinner, P. Sigmund. *Nucl. Instrum. Methods B* **467** (2020) 91-96

### **The Bloch correction, key to heavy-ion stopping**

P. Sigmund, A. Schinner. *J. Appl. Phys.* **128** (2020) 100903

### **Height and Position of the Bragg Peak in the stopping of charged particles**

P. Sigmund, A. Schinner. *J. Appl. Phys.* **127** (2020) 164302

### **Expanded PASS stopping code**

A. Schinner, P. Sigmund. *Nucl. Instrum. Methods B* **460** (2019) 19-26

### **Reciprocity analysis of electronic stopping of slow ions**

P. Sigmund, V. Kuzmin, A. Schinner. *Nucl. Instrum. Methods B* **460** (2019) 10-18

### **Is electronic stopping of ions velocity-proportional in the velocity-proportional regime?**

P. Sigmund, A. Schinner. *Nucl. Instrum. Methods B* **440** (2019) 41-47

**Electronic stopping in oxides beyond Bragg additivity**

P. Sigmund, A. Schinner. Nucl. Instrum. Methods B **415**, 110-116 (2018)

**Note on measuring electronic stopping of slow ions**

P.Sigmund, A.Schinner. Nucl. Instrum. Methods B **410**, 78-88 (2017)

**Progress in understanding heavy-ion stopping**

P. Sigmund, A. Schinner. Nucl. Instrum. Methods B **382**, 15-25 (2016)

**Systematics of heavy-ion charge-exchange straggling**

P. Sigmund, A. Schinner. Nucl. Instrum. Methods B **384**, 30-36 (2016)

**Notes on Barkas-Andersen Effect**

P.Sigmund, A.Schinner. Eur. Phys. J. D **68** (2014) 318

**Velocity Dependence of Heavy-Ion Stopping below the Maximum**

P.Sigmund, A.Schinner. Nucl. Instrum. Methods B **342** (2014) 292-299s

**Anatomy of Charge-Exchange Straggling**

P.Sigmund, O.Osmani, A.Schinner. Nucl. Instrum. Methods B **338** (2014) 101-107

**Energy-loss straggling of 2-10 MeV/u Kr ions in gases**

C.Vockenhuber, J.Jensen, J.Julin, H.Kettunen, M.Rossi, T.Sajavara, O.Osmani, A.Schinner, P.Sigmund, H.J.Whitlow. Europ. Phys. J. D **67** (2013) 145

**Polarization wake of penetrating ions: Oscillator model**

A. Schinner, P. Sigmund. Eur. Phys. J. D **66** (2012) 56, 1-11

**Stopping of swift hydrogen diclusters: Oscillator model**

P. Sigmund, A. Schinner. Eur. Phys. J. D **61** (2011) 39-50

**Charge-Exchange Straggling in Equilibrium**

P. Sigmund, O. Osmani, A. Schinner. Nucl. Instrum. Methods B **269** (2011) 804-809

**Exploring reciprocity as a tool in low-energy electronic stopping**

V. Kuzmin, P. Sigmund. Nucl. Instrum. Methods B **269** (2011) 817-823

**Charge-state evolution of swift heavy-ion beams explored by matrix method**

O. Osmani, P. Sigmund. Nucl. Instrum. Methods B **269** (2011) 813-816

**Impact-parameter-dependent stopping of swift ions. I. Binary theory**

A. Schinner, P. Sigmund. Europ. Phys. J. D **56** (2010) 41-50

**Impact-parameter-dependent stopping of swift ions. II. Application to channeling**

P. Sigmund, A. Schinner. Eur. Phys. J. D **56** (2010) 51-60

**Impact-parameter-dependent stopping of swift ions. III. Bunching and packing in energy-loss straggling**

P. Sigmund, A. Schinner. Eur. Phys. J. D **58** (2010) 105-116

**Stopping of ions heavier than helium. Erratum**

P.Sigmund, H. Paul, A.Schinner. J. ICRU, [http://icru.org/images/pdf/errata\\_and\\_addenda.pdf](http://icru.org/images/pdf/errata_and_addenda.pdf) (2009)

**Reciprocity in the electronic stopping of slow ions in matter**

P. Sigmund. Eur. Phys. J. D **47** (2008) 45-54

**Antiproton and proton energy loss straggling at keV energies**

S.P.Møller, A.Csete, T.Ichioka, H.Knudsen, H.-P.Kristiansen, U.I.Uggerhøj, H.H.Andersen, P.Sigmund, A.Schinner. Eur. Phys. J. D **46** (2008) 89-92

**Energy-loss spectra of light relativistic ions. Erratum**

L. G. Glazov, P. Sigmund. Nucl. Instrum. Methods B **266** (2008) 5067

**Energy-loss spectra of light relativistic ions**

L.G.Glazov, P.Sigmund. Nucl. Instrum. Methods B **256** (2007) 50-56

**Semiclassical theory of the energy loss of ions in matter**

N. R. Arista, P. Sigmund. Phys. Rev. A **76** (2007) 062902

**Z2 structure and gas-solid effect in the stopping of slow ions**

P. Sigmund, A. Schinner. Nucl. Instrum. Methods B **263** (2007) 349-356

**Stopping of high-Z ions at intermediate velocities**

A. Fettouhi, H. Geissel, A. Schinner, P. Sigmund. Nucl. Instrum. Methods B **245** (2006) 22-27

**Shell correction in stopping theory**

P.Sigmund, A.Schinner. Nucl. Instrum. Methods B **243** (2006) 457-460

**Binary stopping theory for swift heavy ions**

P.Sigmund, A.Schinner. Europ. Phys. J. D **37** (2006) 155

**Valence structure effects in the stopping of swift ions**

P.Sigmund, A.Sharma, A.Schinner, A.Fettouhi. Nucl. Instrum. Methods B **230** (2005) 1-6

**Interplay of classical and quantum mechanics in the theory of charged-particle stopping**

P.Sigmund. Adv. Qu. Chem. **48** (2005) 91-110

**Stopping of swift ions in compounds**

A.Sharma, A.Fettouhi, A.Schinner, P.Sigmund. Nucl. Instrum. Methods B **218** (2004) 19-28

**Material dependence of electronic stopping**

P.Sigmund, A.Fettouhi, A.Schinner. Nucl. Instrum. Methods B **209** (2003) 19-25

**Nuclear energy loss in stopping measurements**

L.G.Glazov, P.Sigmund. Nucl. Instrum. Methods B **207** (2003) 240-256

**Barkas effect, shell correction, screening and correlation in collisional energy-loss straggling of an ion beam**

P.Sigmund, A.Schinner. Europ. Phys. J. D **23** (2003) 201-209

**Binary theory of electronic stopping, a powerful update to Bohr's classic from 1913**

P.Sigmund, A.Schinner. AIP Conference Proceedings **680** (2003) 98-101

**Bohr did not make an elementary blunder**

P.Sigmund. Radiat. Eff. Def. Solids **158** (2003) 551-552

**Interplay of charge exchange and projectile excitation in the stopping of swift heavy ions**

P.Sigmund, L.Glazov. Europ. Phys. J. D **23** (2003) 211-215

**Anatomy of the Barkas effect**

P.Sigmund, A.Schinner. Nucl. Instrum. Methods B **212** (2003) 110-117

**Binary Theory of Electronic Stopping**

P.Sigmund, A.Schinner. Nucl. Instrum. Methods B **195** (2002) 64-90

**Binary Theory of Light-Ion Stopping**

P.Sigmund, A.Schinner. Nucl. Instrum. Methods B **193** (2002) 49-55

**Statistics of heavy-ion stopping**

L.G.Glazov, P.Sigmund, A. Schinner. Nucl. Instrum. Methods B **195** (2002) 183-187

**Panel discussion on stopping of heavy ions**

A.Baurichter, P.Sigmund, A.H.Sørensen. Nucl. Instrum. Methods B **195** (2002) 224-231

**Nonperturbative theory of charge-dependent heavy-ion stopping**

P.Sigmund, A.Schinner. Phys. Scr. **T92** (2001) 222

**Resolution of the frozen-charge paradox in stopping of channeled heavy ions**

P.Sigmund, A.Schinner. Phys. Rev. Lett. **86** (2001) 1486-1489

**Effective charge and related/unrelated quantities in heavy-ion stopping**

P.Sigmund, A.Schinner. Nucl. Instrum. Methods B **174** (2001) 535-540

**Heavy-ion stopping: Bohr theory revisited**

P.Sigmund, A.Schinner. Fundamental & Applied Aspects of Modern Physics, ed. by S.H.Connell & R.Tegen **World Sci.** (2001) 178-187

**Binary theory of antiproton stopping**

P.Sigmund, A.Schinner. Europ. Phys. J. D **15** (2001) 165

**Electronic Stopping of Swift Partially-Stripped Molecules and Clusters**

J. Jensen, P.Sigmund. Phys. Rev. A **61** (2000) 032903 (1-14)

**Electronic stopping of swift lithium and carbon ions**

H.Paul, A.Schinner, P.Sigmund. Nucl. Instrum. Methods B **164-165** (2000) 212-219

**Polarization effect in stopping of swift partially-screened heavy ions: Perturbative theory**

A.Schinner, P.Sigmund. Nucl. Instrum. Methods B **164-165** (2000) 220-229

**Stopping power: Wrong Terminology**

P.Sigmund. ICRU News **1** (2000) 5-6

**Shell correction in Bohr stopping theory**

P.Sigmund. Europ. Phys. J. D **12** (2000) 111-116

**Energy-loss spectra of charged particles in the presence of charge exchange: Addendum on  ${}^6\text{Li}$  spectra**

L.Glazov, P.Sigmund. Nucl. Instrum. Methods B **170** (2000) 39-44

**Binary theory of heavy-ion stopping**

P.Sigmund, A. Schinner. Europ. Phys. J. D **12** (2000) 425-434

**Stopping power: Wrong terminology. Author's response**

P.Sigmund. ICRU News Internet Edition **December** (2000) # 7

**Energy Loss and Charge Exchange: Statistics and Atomistics**

P. Sigmund, L.G.Glazov. Nucl. Instrum. Methods B **136-138** (1998) 47-54

**Statistical Theory of Charged-Particle Stopping in the Presence of Charge Exchange (Erratum)**

P.Sigmund. Nucl. Instrum. Methods B **134** (1998) 435

**Energy-Loss Spectrum of Charged Particles in the Presence of Charge Exchange**

L. Glazov, P.Sigmund. Nucl. Instrum. Methods B **125** (1997) 110-115

**Forces on Swift Particles near Plane Surfaces**

P.Sigmund. Nucl. Instrum. Methods B **125** (1997) 77-96

**Charge-Dependent Electronic Stopping of Swift Heavy Ions**

P.Sigmund. Phys. Rev. A **56** (1997) 3781-3793

**Statistics of Projectile States and Correlated Phenomena for Penetrating Ions**

P.Sigmund. Nucl. Instrum. Methods B **115** (1996) 111-124

**Low-Speed Limit of Bohr's Stopping-Power Formula**

P.Sigmund. Phys. Rev. A **54** (1996) 3113-3117

**Charge-Exchange and Energy-Loss Statistics of Swift Penetrating Ions**

P.Sigmund, A.Närman. Laser and Particle Beams **13** (1995) 281-292

**Note on Stopping Power and Statistics of Particle Penetration**

P.Sigmund. Nucl. Instrum. Methods B **95** (1995) 477-479

**Light-Ion Stopping near the Maximum**

P.Sigmund. Nucl. Instrum. Methods B **85** (1994) 541-550

**Oriental Dependence of Electronic Stopping of Molecule and Cluster Ions**

J.Jensen, H.H.Mikkelsen, P.Sigmund. Nucl. Instrum. Methods B **88** (1994) 191-195

**Statistics of Energy-Loss and Charge Exchange of Penetrating Particles: Higher Moments and Transients**

A.Närman, P.Sigmund. Phys. Rev. A **49** (1994) 4709-4715

**Analysis of Charge-State Dependent Stopping of Swift Ions**

P.Sigmund. Phys. Rev. A **50** (1994) 3197-3201

**Statistical Theory of Charged-Particle Stopping and Straggling in the Presence of Charge Exchange**

P.Sigmund. Nucl. Instrum. Methods B **69** (1992) 113-122

**Intercomparison of atomic models for computing stopping parameters from the Bethe theory: Atomic hydrogen**

H.H.Mikkelsen, A.Meibom, P.Sigmund. Phys. Rev. A **46** (1992) 7012-7018

**Impact Parameter Dependence of Light-Ion Electronic Energy Loss**

E.H.Mortensen, H.H.Mikkelsen, P.Sigmund. Nucl. Instrum. Methods B **61** (1991) 139-148

**The Z13 Contribution to the Stopping Power of Protons and Antiprotons in Silicon: Two Theoretical Predictions**

H.H.Mikkelsen, H.Esbensen, P.Sigmund. Nucl. Instrum. Methods B **48** (1990) 8-9

**Stopping Power and Energy Loss Cross Section of a Point Charge Penetrating through a Dense Medium of Bound Electrons**

A.Belkacem, P.Sigmund. Nucl. Instrum. Methods B **48** (1990) 29-33

**Barkas Effect in a Dense Medium: Stopping Power and Wake Field**

H.Esbensen, P.Sigmund. Ann. Physics **201** (1990) 152-192

**Barkas Effect in Electronic Stopping Power: Rigorous Evaluation for the Harmonic Oscillator**

H.H.Mikkelsen, P.Sigmund. Phys. Rev. A **40** (1989) 101-116

**Impact Parameter Dependence of Electronic Energy Loss: Oscillator Model**

H.H.Mikkelsen and P.Sigmund. Nucl. Instrum. Methods B **27** (1987) 266-275

**Bethe Stopping Theory for a Harmonic Oscillator and Bohr's Oscillator Model of Atomic Stopping. Erratum**

P.Sigmund and U.Haagerup. Phys. Rev. A **35** (1987) 3965

**Bethe Stopping Theory for a Harmonic Oscillator and Bohr's Oscillator Model of Atomic Stopping**

P.Sigmund and U.Haagerup. Phys. Rev. A **34** (1986) 892-910

**Higher Moments of the Energy Loss Spectrum of Swift Charged Particles Penetrating a Thin Layer of Material**

P.Sigmund and K.Johannessen. Nucl. Instrum. Methods B **6** (1985) 486-495

**Stopping Power at Intermediate Velocities**

P.Sigmund. Nucl. Instrum. Methods B **10/11** (1985) 241-246

**Energy Loss Spectrum of Swift Charged Particles Penetrating a Layer of Material**

P.Sigmund and K.B.Winterbon. Nucl. Instrum. Methods B **12** (1985) 1-16

**On the Proton Stopping Power Maximum in Gases and Vapours**

J.R.Sabin, J.Oddershede, and P.Sigmund. Nucl. Instrum. Methods B **12** (1985) 80-83

**Predicted Z2-Structure and Gas-Solid Difference in Low-Velocity Stopping Power of Light Ions**

J.Oddershede, J.R.Sabin, and P.Sigmund. Phys. Rev. Lett. **51** (1983) 1332

**Energy Loss Straggling of a Point Charge Penetrating a Free Electron Gas**

P.Sigmund and D.J.Fu. Phys. Rev. A **25** (1982) 1450-1455

**Kinetic Theory of Particle Stopping in Medium with Internal Motion**

P.Sigmund. Phys. Rev. A **26** (1982) 2497-2517

**Secondary Electron Spectra from Dielectric Theory**

D.K.Brice and P.Sigmund. Mat. Fys. Medd. Dan. Vid. Selsk. **40** (1980) 1-34

**Statistics of Particle Penetration in Molecular Gases and Noncrystalline Solids "Radiation Research**

P.Sigmund. Radiation Research, S.Okada et al. eds., Tokyo (1979) 110-120

**Statistics of Particle Penetration**

P.Sigmund. Mat. Fys. Medd. Dan. Vid. Selsk. **40** (1978) 1-36

**Energy Loss of Charged Particles to Molecular Gas Targets**

P.Sigmund. Phys. Rev. A **14** (1976) 996-1005