# Index

## A
- Asymmetric heating, 121–125

## B
- Background limited operation, 210
- Beam–background fusion scaling, 26
- Beam–beam fusion scaling, 13
- Beam–gas reaction, 210, 367
- BF$_3$ neutron detector, 290, 292
- Borda’s profile, 104
- Bounce-averaged Fokker–Plank (BAFP) code, 369–377
- Breakdown voltage, 68, 73
- Bremsstrahlung radiation, 6, 60, 229, 232
- Bruce’s profile, 104
- Bubble detector, 296
- Busbar, 97
- Bushing, 97–99

## C
- Calibration factor, 144, 155, 164–169, 177, 293
- Carbon nanotubes (CNTs), 6, 129–132, 137, 283
- C-Device, 80, 81, 240, 359, 361
- Central “core” region, 5
- “Central spot” mode, 14, 15, 318, 357
- Charged particle detector, 298, 311, 331, 3187
- Charge exchange (CX) collisions/reactions, 3, 261, 314, 322, 386
- Charge exchange emission spectroscopy, 324
- Child–Langmuir law, 183–186
- Chordwire, 118, 119, 144, 145
- CNTs. See Carbon nanotubes (CNTs)

## D
- DaIEC. See Dipole assisted IEC (DaIEC)
- Deuterium–helium-3 (D–$^3$He), 1
- Diagwire, 119–121
- Dielectric, 92, 96, 97, 99–105, 107, 108, 278, 279, 327
- Dipole assisted IEC (DaIEC), 245–248
- Direct current (DC) glow discharge, 69
- Doppler shift spectroscopy, 321, 322, 325
- Double well, 34–36, 117, 270, 318, 320, 374–378, 380

## E
- Eclipse disc, 145–149, 155, 157, 158, 166, 177
- Effective transparency, 78, 79, 115, 129, 139, 386
- Electron angular momentum, 40

Electron–hole pair, 298, 299, 308
Electron injected IEC, 279–285
Energy balance analysis, 384
Energy loss mechanism, 219–224

F
Faraday cup, 253, 278, 323, 331, 358
Faraday trap, 315, 316, 318, 327–329
Fast neutron analysis (FNA), 345, 346
Field emission, 68, 69, 92, 93, 95, 96, 117, 182, 198, 206, 218, 228, 233–234
FNA. See Fast neutron analysis (FNA)
Full width half maximum (FWHM) value, 300, 304
Fusion–fission hybrid reactor, 335, 358
Fusion ion doppler (FIDO) diagnostic, 155, 311–313
“Fusors,“ 2
Fuzzy logic analysis system, 348–349

G
Gas discharge, 17, 67–81, 171, 240, 248, 264
Gaseous plasma discharge, 67
GEA. See Gridded energy analyzer (GEA)
Geiger–Mueller region, 291, 292
“Glow” discharge, 69–73, 170, 217, 218, 268, 380
Gridded energy analyzer (GEA), 278, 325–327, 331, 357, 358
Gridded inertial electrostatic confinement (IEC), 3–5, 14, 16, 26, 67–81, 120, 181, 185, 196, 210, 229, 248, 255, 279, 294, 304, 314–315, 359, 380
Grid radius, 107–108, 189–190
Grid rotation experiment, 150, 152–155, 204, 219
Grid symmetry, 13, 139, 158

H
Half-width at half maximum (HWHM) radius, 203
Hall thrusters, 244, 245, 356
“Halo”/“jet” mode, 14, 15, 146, 159, 160, 169–173, 177, 329, 349, 357
\(^3\)He cylindrical transmutation reactor (\(^3\)HeCTRE), 241
Helicon, 261, 273–278, 286, 325, 356
\(^3\)He neutron detector, 141
HEU. See Highly enriched uranium (HEU)
HEU detection system, 341
Highly enriched uranium (HEU), 340–343
High-voltage bushing, 97
High-voltage feedthrough/high-voltage (HV) stalk, 3, 69, 83–112, 126, 131, 152–153, 177, 215, 219
High-voltage (HV) stalk design, 83–112
HIIPER. See Helicon-Injected Inertial Plasma Electrostatic Rocket (HIIPER)
“Homer” device, 16–18, 195, 295
Hot plasma, 1
Hydrogen–boron-11 (H–B\(^{11}\)), 1, 388, 390

I
ICF. See Inertia confinement fusion (ICF)
Impurity ions, 229
Inertia confinement fusion (ICF), 1, 5, 7
Integrated interrogation system, 346–345
Ion-injected IEC, 65, 247, 250, 261, 367–369, 382, 383
Ion lifetime, 86, 196, 210–213
Ion recirculation, 5, 53, 85, 90, 111, 124, 129, 139, 145, 224, 272, 362
Ion trajectory, 77, 78, 83, 84, 86, 317
IXL computer simulation code, 34

L
Langmuir probe, 199, 246, 321–325
Laser induced fluorescence (LIF), 318–321, 324, 381
M
- Magnetically-Channeled SIEC Array (MCSA), 352–356
- Magnetic assisted IEC, 255–258
- Magnetic deflection energy analyzer diagnostic, 328, 329
- Magnetic field confinement, 1
- Magnetron discharge ion source, 272
- MARBLE. See Multiple ambipolar recirculating beam line experiment (MARBLE)

MCSA. See Magnetically-Channeled SIEC Array (MCSA)

Medical isotope, 241, 243, 257, 258, 273, 308, 314, 335–339, 362

Metallic hydride getter, 271

Microchannel IEC thruster concept, 248

Microchannels, 14, 34, 73, 77–79, 86, 115, 124, 129, 139, 141, 145, 154–156, 158–168, 171, 172, 176, 177, 243, 244, 248, 249

Monte Carlo N-particle (MCNP) code, 226

Monte Carlo stopping and range of ions in matter (SRIM), 304

Multi-grid, 132–136, 212–217, 389

Multiple ambipolar recirculating beam line experiment (MARBLE), 249–255, 258, 259, 390

N

NAA. See Neutron activation analysis (NAA)

Natural diamond detectors, 308–313

Neutron activation analysis (NAA), 2, 9, 10, 49, 67, 73, 249, 258, 271, 272, 289, 335, 339, 343, 345

Neutron detector, 141, 145, 177, 219, 223, 289–295, 297, 331, 344

Neutron production rate (NPR), 13, 14, 17, 86, 107, 117, 119–121, 139, 140, 145, 151, 154, 173, 207, 210, 218, 261, 263, 266, 286, 289, 294


Non-condenser bushing, 98–99

Non-Maxwellian plasma, 1, 2, 355, 367, 382, 387

Non-self-sustaining discharge, 67, 68, 71

NPR. See Neutron production rate (NPR)

P

Parallel plate vacuum diode, 181–183

Particle-in-cell (PIC) code, 173, 175, 213, 382–384, 388

simulation, 202

Paschen curve, 68, 75, 170, 171, 173–175, 257, 268

Penning fusion (PF) concept, 25

Penning fusion experiment (PFX), 283–285

Penning trap, 24, 25, 239, 253, 261, 280, 283–286, 369, 390

Periodically oscillating plasma spheres (POPS), 10, 21–23, 49, 131, 239, 259, 261, 279–283, 286, 287, 390

PFNA. See Pulsed fast neutron analysis (PFNA)

PFX. See Penning fusion experiment (PFX)

Photo emission, 117, 198, 206

Pinhole formation, 85

Plasma force sensor, 330–331


Poissons, 11, 12, 34, 47, 50, 55, 57, 150, 207, 266

Polywell concept, 24–25, 57, 59, 65

POPS. See Periodically oscillating plasma spheres (POPS)

Positron emission tomography (PET) isotopes, 308, 313–314, 337

Potential well formation, 11, 31, 36, 47, 64, 262, 382

Pre-breakdown conduction mechanism, 92–93


Proton/neutron (P/N) ratio, 144–145

Pulsed fast neutron analysis (PFNA), 345, 346

Pulsed power supply, 268, 346–348

Q

Q-value, 368, 370–372

R

Radial converging IEC (RC-IEC), 241

Radio-frequency (RF) discharge, 70

ion injector “gun” (also RF gun/gun), 20, 21, 263

Rapid prototyping, 129, 130

Reaction rate scaling law, 209

Research reactor, 359, 360, 362
<table>
<thead>
<tr>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ring-shaped magnetron ion source (RS-MIS), 19–20, 217, 218, 272</td>
</tr>
<tr>
<td>Rogowski profile, 104</td>
</tr>
</tbody>
</table>

**S**
- Scaling law, 80, 172, 173, 177, 209, 376
- Scintillation detector, 313–318
- Secondary electron emission (SEE), 25, 69, 96, 107, 121, 132, 175, 176, 199, 222–228, 235, 309
- Self-sustaining discharge, 67, 68, 71
- SIGFE. See Six ion gun fusion experiment (SIGFE)
- Silicon detector, 298–300, 308–311, 313
- Silver activation detector, 294, 297
- SIMION-charged particle optics software package, 317
- Single loop grid, 118, 143, 155–169, 219, 220, 234, 311
- Six ion gun fusion experiment (SIGFE), 264–266, 286, 389
- Solid-state detector, 266, 297–308
- Space charge limited flow model, 17, 207
- Spaceship II, 244
- Spherical IEC geometry, 242
- Spherically convergent ion focus (SCIF) device, 57
- Sputter, 126–128
- “Star” mode, 79, 129, 137, 146, 150, 151, 160, 169, 170, 211, 244, 261, 267, 269, 318, 320, 357, 380, 386
- Surface breakdown, 87, 92

**T**
- Thermal neutron analysis (TNA), 345, 346
- Thermionic emission, 18, 69, 115–121, 125, 127, 128, 137, 198, 206, 218, 219, 222, 223, 228
- Time-of-flight (TOF) diagnostic, 345
- TNA. See Thermal neutron analysis (TNA)
- Tokamak, 1, 10, 351, 352, 391
- Townsend regime, 71, 73
- Traveling wave direct energy converter (TWDEC), 214, 351, 353

**V**
- Virtual anode, 11–13, 17, 34–36, 47, 52–54, 56, 150, 202, 322, 324, 325, 374, 380
- Virtual cathode, 8, 9, 11, 25, 34, 35, 45–49, 53, 55, 169, 253, 324, 374, 375, 378
- Virtual electrode, 3, 7–9, 13, 26, 34, 47, 53, 54, 56, 117, 120, 181, 207, 253, 263, 377–379, 391
- Voltage breakdown, 23, 85, 95, 137, 254, 283, 286
- Voltage–current (V–I) characteristics, 67, 71, 72

**W**
- Water-jacketed IEC neutron source, 341

**X**
- X-ray source, 10, 335–336, 343