NBODY6 ROUTINES

Routine	Called by	Description
ADJUST	NBODY6	Parameter adjustment & energy check.
ASSESS	KSINT	Assessment of hierarchical stability.
BINDAT	OUTPUT	Binary data bank on unit 9 (option 8 >= 3).
BINEV	CHAOS & MDOT	Stages of binary evolution (also COAL).
BINOUT	OUTPUT	Binary analysis & output (#8 > 0).
BINPOP	DATA	Initial binary distribution (#8).
BLOCK		Block data initialization of local labelled COMMON.
BODIES	OUTPUT	Output of single particles & binaries (#9 & #6).
BRAKE	UNPERT	Magnetic braking and gravitational radiation (#28).
BRAKE2	MDOT	Gravitational radiation of hierarchical binary.
BSETID	MDOT & ROCHE	Tidal synchronization for circular orbits (#34).
CHAOS0	CHAOS & CHRECT	Initial chaos boundary (#27; also HIGROW).
CHAOS	KSTIDE	Chaotic tidal interactions (#27).
CHECK	ADJUST	Error check & restart (#2 & #17).
CHECKL	REGINT	Addition of neighbours during regular step (#18).
CHRECT	KSINT & MDOT	Rectification of chaotic orbits (#27; also DECIDE).
CLINT	INTGRT	Integration of interstellar cloud (#13).
CLOUD0	START	Initialization of cloud parameters (#13).
CLOUD	CLOUD0 & NBINT	Generation of interstellar cloud (#13).
CMBODY	KSINT & TRIPLE	Formation of c.m. body by collision (also CHAIN).
CMCORR	ADJUST	Correction of c.m. coordinates & velocities (#31).
CMFIRR	NBINT	Irregular force on c.m. particle.
CMFREG	REGINT	Regular & irregular force on c.m. particle.
COAL	EXPEL & EXPEL2	Coalescence of Roche or CE binary (#34).
COMENV	ROCHE & EXPEL	Common envelope evolution (#34 & #19).
CORE	ADJUST & OUTPUT	Density centre & core radius.
CORERD	DGCORE & SYNCH	Core radius of giant (#19; also SPIRAL).
CPUTIM	ADJUST & INTGRT	Elapsed CPU time in minutes (initialized in NBODY6).
DATA	START	Generation of initial conditions.
DECIDE	IMPACT	Hierarchical stability decisions.
DEFINE	INPUT	Definition of input parameters, options & counters.
DEFORM	IMPACT & ROCHE	Deformation of elliptic orbits (also SYNCH).
DEGEN	MDOT & ROCHE	Degenerate binary diagnostics (#19; also CMBODY).
DELAY	IMPACT & INTGRT	Delay of multiple requlariza tion & merger (#15).
DGCORE	COMENV	Collision or coalescence of two degenerate cores (#34).
DTCHCK	CMBODY & COAL	Maximum commensurate step for activating ghosts.
ECCMOD	KSINT	Eccentricity modulation of hierarchical binary (#27).
ECIRC	DECIDE	Eccentricity for a given circularization time (#27).
EDOT	DECIDE	Eccentricity derivative due to dominant perturber (#27).
EFAC2	TIDES	Tidal capture efficiency factor for second harmonic.
EFAC3	TIDES	Tidal capture efficiency factor for third harmonic.
ENERGY	ADJUST & SCALE	Total energy (including binaries & tidal field).

ESCAPE	ADJUST	Removal of escaping particles (#23).
EVENTS	OUTPUT	Output of mass loss & tidal capture events (#19 & 27).
EVOLVE	INTGRT & KSINT	Diagnostic output of interacting binaries (#4; unused).
EXPAND	HCORR	Expansion or contraction of KS orbit (#19).
EXPEL	CMBODY & SPIRAL	Preparation for common envelope stage (#19).
FCLOSE	CMBODY & RESET	Force & first derivative of close bodies (START3 & 4).
FCLOUD	REGINT & FPOLY1	Force & derivative from interstellar clouds (#13).
FCORR	MDOT	Global corrections for mass loss from evolving stars.
FDISK	XTRNLF & GCINT	Tidal force due to Miyamoto disk (#14 = 3).
FHALO	XTRNLF & GCINT	Tidal force due to logarithmic halo (#14 = 3).
FICORR	MDOT	Local corrections due to mass loss.
FINDJ	BINDAT & HRPLOT	Find merger and ghost index (also MDOT).
FINDM	NEWTEV	Find ghost mass.
FLYBY	KSINT	Termination check of perturbed KS orbit.
FNUC	XTRNLF & GCINT	Tidal force due to point-mass (#14 = 3).
FPCORR	REGINT	Force polynomial derivative corrections (#38).
FPERT	SEARCH & IMPACT	Perturbing force on dominant components.
FPOLY1	START & KSINIT	Total force & first derivative (also START3 & 4).
FPOLY2	START & KSINIT	Second & third force derivatives (also START3 & 4).
FREEZE	KSINT	Partial reflection of KS orbit (#25; suppressed).
GCINIT	XTRNL0	Initialization of guiding centre orbit (#14 = 3).
GCINT	INTGRT	Integration of guiding centre (#14 = 3).
GIANT	CHAOS & SYNCH	Structure constants of giant star (#19; also TCIRC).
GIANT3	HIGROW & QTIDES	Structure constants of giant star (#19 & 27).
GNTAGE	CMBODY	Age of giant star.
GRRAD	MDOT & ROCHE	Gravitational radiation for close binary (#19).
HCORR	MDOT	Mass loss correction of KS orbit (#19).
HIARCH	MERGE & RESET	Diagnostics of hierarchical systems (#18; also ESCAPE).
HICIRC	ECCMOD & HIGROW	Eccentricity for given T_{circ} in hierarchy (#27).
HIDAT	OUTPUT	Hierarchical data bank on unit #87 (#8 > 3).
HIGROW	ECCMOD	Induced change of hierarchical binary (#27).
HIMAX	HIDAT	Maximum eccentricity of hierarchy.
HIMOD	HIGROW	Modification of hierarchical binary (#27).
HIPOP	START	Primordial hierarchical triples (#18 = 2).
HIRECT	HIGROW & BRAKE2	Rectification of hierarchical binary (#27).
HISTAB	UNPERT	Hierarchical stability criterion (MA99).
HIVEL	INTGRT	High-velocity particle search (# 37 > 0).
HMDOT	MDOT	Mass loss from inner hierarchical binary (#19).
HMDOT2	MDOT	Mass loss from outer hierarchical binary (#19).
HOTSYS	START	Hot initial system (#29; suppressed).
HRDIAG	INSTAR & MDOT	H-R parameters for stellar evolution (#19 & 27).
HRPLOT	OUTPUT	HR diagram of evolving stars (#12).
HUT	SPIRAL	Evolution equations for eccentricity and spin (#27).
HUT2	SYNCH	Spin evolution of circular binary (#27).
IBLOCK	START	Initialization of hierarchical block-steps (40 levels).

IMF	DATA	Initial mass function (#20 = 1; iteration method).
IMF2	DATA	Initial mass function (#20 > 1; binaries & singles).
IMFBD	IMF2	IMF with brown dwarfs (#20 = 6; Pavel Kroupa version).
IMPACT	KSINT & UNPERT	Search for multiple encounters or merger (#15).
INDUCE	IMPACT & KSTIDE	Induced eccentricity of hierarchical binary (#27).
INEXT	INTGRT	Determination of next particles.
INPUT	START	Main input.
INSERT	SUBINT	Insertion of particle index in KS time-step list.
INSTAR	START	Initialization of stellar evolution parameters (#19).
INTGRT	NBODY6	Decision-making & control of integration paths.
INTIDE	START	Input & scaling for tidal capture (#27; suppressed).
JACOBI	OUTPUT	Current escaper number (with or without tidal field).
KEPLER	NBINT	Step reduction of binary c.m. & close perturber (#36).
KICK	KSAPO & FCORR	Velocity kick for neutron stars (#19).
KICK2	ROCHE	Velocity kick for Roche NS & BH stars (#34).
KSAPO	UNPERT	Transformation of KS variables by PI/2 or at random.
KSCORR	KSINT	Stumpff corrector for KS regularization.
KSIN2	MERGE2 & RESET2	Initialization of hierarchical KS.
KSINIT	KSREG	Initialization of KS regularization.
KSINT	INTGRT	Regularized two-body integration.
KSLIST	KSINT & RESET	Selection of KS perturbers (also KSINIT & KSTIDE).
KSMOD	KSINT	KS motion modified by slow-down (#26).
KSPERI	KSINT & KSTIDE	KS variables at pericentre.
KSPERT	KSINT	Perturbation on KS pair.
KSPOLY	KSINIT & KSINT	New KS polynomials (also KSMOD & RESET).
KSPRED	KSINT	Prediction for KS regularization.
KSRECT	KSTERM	Rectification of KS variables to correct energy.
KSREG	NBODY6 & MERGE	Preparation of new KS regularization (also RESET).
KSRES	MERGE & XTPERT	Interpolation & coordinate transformation of KS pair.
KSRES2	INTGRT & CMFIRR	Coordinates & velocities of KS pair.
KSTERM	NBODY6 & MERGE	Termination of KS regularization (RESET & IMPACT).
KSTIDE	KSINT	Tidal interaction of KS pair (#27).
LAGR	ADJUST & OUTPUT	Lagrangian radii & half-mass radius (#7).
LAGR2	OUTPUT	Lagrangian & half-mass radi of two mass groups (#7 = 6).
LEVELS	OUTPUT	Diagnostic output of block-steps (#33).
MAGBRK	MDOT & ROCHE	Spin change due to magnetic braking (#19, #34).
MATRIX	KSINIT & KSPOLY	Levi-Civita matrix (also KSCORR, KSRES2 & RESOLV).
MDOT	INTGRT	Mass loss from evolving stars (#19 >= 3).
MERGE	NBODY6	Merging of hierarchical triple or quadrupole.
MERGE2	MERGE	Merging of double hierarchy.
MIX	CMBODY	Evolution parameters for mixed star (#19).
MLOSS	INTGRT	Mass loss from evolving stars (old version; #19 = 1).
MLWIND	MDOT	Reimers mass loss from stellar wind (#19 >= 3).
MODIFY	NBODY6	Modified input parameters at restart.
MRENV	HRDIAG	Mass and radius of convective envelope (#19).

MTRACE	MDOT	Orbit diagnostics for mass loss (suppressed).
MYDUMP	ADJUST & INTGRT	COMMON save or restart (also NBODY6; #1 & #2).
NBINT	INTGRT	Irregular integration and corrector.
NBLIST	START	Initialization of neighbour list (also START3 & 4).
NBODY6		Master control flow.
NBPOT	MERGE & RESET	Potential energy of subsystem (also TRIPLE & QUAD).
NBREM	MERGE	Ghost removal from neighbour lists (also START3 & 4).
NBREST	RESET	Restoring ghosts in neighbour lists (also START3 & 4).
NBSORT	INTGRT	Neighbour list sorting.
NBTIDE	NBINT	Tidal two-body interaction (#27 < 0; suppressed).
NEWTEV	MERGE2	Next look-up time for hierarchy (#19 >= 3).
NSTAB	IMPACT	Three-body stability criterion (also ASSESS & RESET2).
NTINT	INTGRT	Integration of single stars in tidal field (#23).
OFFSET	ADJUST	Offset of global times (#35).
ORBIT	NBINT	Close encounter search for small eccentricity.
OUTPUT	ADJUST & INTGRT	Main output & optional data save.
PERI	KSINT	Pericentre of two-body motion (also TRIPLE & QUAD).
PERMIT	IMPACT	Decision-making for new triple, quad or chain.
PFAC	HIMAX	Precession factor for hierarchy.
POTI	EXPEL & MTRACE	Potential of one particle from explicit sum.
PROTO	BINPOP	Pre-main sequence binary evolution (Pavel Kroupa).
QTIDES	HIGROW	Quadrupole and tidal terms for hierarchical binary (#27).
RAN2	DATA & BINPOP	Portable random number generator (also CLOUD).
REFLCT	REGINT	Boundary reflection (#29; suppressed).
REGINT	INTGRT	Regular integration and corrector.
REMOVE	KSTERM & ESCAPE	Removal of particle or KS pair from COMMON tables.
RENAME	KSREG	Renaming of COMMON tables for new KS pair.
RESET	NBODY6	Termination of hierarchical merger.
RESET2	RESET	Termination of double hierarchy.
RESOLV	ENERGY & XVPRED	Coordinates & velocities of KS pair (also KSTERM).
RKINT	HIMOD	Runge-Kutta integrator for tidal interactions (#27).
RL	ROCHE & BRAKE2	Analytical Roche radius relation (#34).
ROCHE	MDOT	Treatment of Roche-lobe overflow (#34).
RPMAX	KSINT	Maximum periastron factor for GR capture (#27).
RPMAX2	KSINT	Maximum periastron factor for capture (#27).
RPMIN	KSINT	Minimum distance for given GR energy change (#27).
SCALE	START	Scaling to new units.
SEARCH	NBINT	Close encounter search for KS regularization.
SETUP	DATA	Initial coordinates & velocities (#22 = 0; Plummer).
SETUP2	DATA	Initial conditions in astrophysical units (#22 = -1).
SHRINK	INTGRT	Shrinking of regular steps in high-velocity encounters.
SORT1	LAGR & IMF2	Sequential sorting of array (Numerical Recipes).
SPIRAL	CHAOS & KSINT	Tidal circularization of binary (#27; also SYNCH).
STABILTY	IMPACT & HISTAB	Three-body stability criterion (MA 1999).
STAR	INSTAR & MDOT	Stellar luminosity & evolution time (also CMBODY).

START	NBODY6	Initial setup & force polynomials.
STEPK	STEPS & NBINT	Selection of block-steps (also in multiple regularizations).
STEPS	FPOLY2	Initialization of time-steps & differences.
STUMPF	KSINT & KSMOD	Modified Stumpff functions (also KSTERM).
SUBINT	INTGRT	Subsystem decision-making (KS, TRIPLE, QUAD, CHAIN).
SWAP	START	Randomized particle swapping (GPU only).
SWEEP	ADJUST	Enforced KS reg of wide binaries (#8 > 0).
SYNCH	MDOT	Spin synchronization of circularized orbit (#19).
TAIL0	ESCAPE	Initialization of tidal tail stars (#14, #23).
TCIRC	BINPOP	Pre-main sequence circularization.
TIDES	KSTIDE & TRIPLE	Tidal energy loss of interacting stars (also QUAD).
TIDES2	CHAOS	Tidal energy dissipation (#27).
TIDES3	KSTIDE	GR tidal energy loss (#27).
TOUCH	KSINT & UNPERT	Collision detector for KS pairs (#27 = -1).
TPERT	KSMOD & UNPERT	Perturbation time-scale.
TRDOT	MDOT & ROCHE	Time-scale for radial expansion (#19; SYNCH).
TRDOT2	NEWTEV & ROCHE	Time-scale for evolution changes (#19).
TRFLOW	KSTIDE & MDOT	Time until Roche overflow (#34; ROCHE & SYNCH).
TSTAB	IMPACT	Hierarchical stability time estimate.
TSTEP	NBINT & STEPS	Standard time-step expression.
UNITS	START	Initialization of units & scaling factors.
UNPERT	KSINT	Unperturbed two-body motion (KS regularization).
UPDATE	KSTERM	Modification of COMMON tables after KS termination.
VERIFY	INPUT & MODIFY	Validation of main input and restart parameters.
XTRNL0	START	Initialization of external force (#14 = 1,2,3).
XTRNLD	FPOLY1 & FPOLY2	External force and higher derivatives on single particle.
XTRNLF	NBINT	External force & first derivative on single particle.
XTRNLP	KSINT & KSPOLY	External perturbation on KS pair.
XTRNLT	NTINT	Galactic force and first derivative (#14).
XTRNLV	ENERGY & NBPOT	External potential (also ESCAPE & BODIES).
XVPRED	ADJUST & MERGE	Prediction of coordinates & velocities (also KSINIT).
ZARE	IMPACT	Zare exchange stability criterion for hierarchies.
ZCNSTS	INSTAR & NBODY6	Initialization of metallicity parameters for ZFUNCS.
ZDATA	ZCNSTS	Metallicity block data for ZCNSTS.
ZERO	START	Initialization of global scalars.
ZFUNCS	STAR & HRDIAG	Fitting functions for stellar evolution.

Three-body regularization

DERQP3	DIFSY3	Derivatives for AZ regularization.
DIFSY3	TRIPLE	Bulirsch-Stoer integrator for AZ.
EREL3	DERQP3 & TRIPLE	Dominant two-body energy in triple system.
EXTEND	SUBSYS & INTGRT	Size of unperturbed triple or quad.
QPMOD3	TRIPLE	Modification of AZ variables for tidal dissipation.
STABL3	QPMOD3 & TRIPLE	Stability test of triple system.
STABLZ	STABL3	Zare stability criterion for exchange.
START3	TRIPLE	Initialization & restart of triple configuration.
SUBSYS	START3 & START4	Initialization of subsystem (TRIPLE, QUAD & CHAIN).
TPERI	DERQP3 & DERQP4	Pericentre time for KS motion (also DERQP & KSINIT).
TRANS3	TRIPLE	Transformation of physical & KS variables for AZ.
TRIPLE	NBODY6 & INTGRT	Main routine for triple regularization.

Four-body regularization

DERQP4	DIFSY4	Derivatives for four-body chain regularization.
DIFSY4	QUAD	Bulirsch-Stoer integrator for chain regularization.
ENDREG	QUAD & RCHAIN	Transformation to physical variables.
EREL4	DERQP4 & QUAD	Dominant two-body energy in four-body system.
ICHAIN	STATUS	Determination of regularized chain.
NEWREG	QUAD & RCHAIN	Initialization of four-body regularization.
NEWSYS	QUAD	Total energy of four-body configuration.
QPMOD4	QUAD	Modification of quad variables for tidal dissipation.
QUAD	NBODY6 & INTGRT	Main routine for four-body regularization.
RCHAIN	QUAD	Decision-making for quad regularization.
RSORT	RCHAIN & STATUS	Sorting of four-body distances.
STABL4	QPMOD4	Stability test of four-body system.
START4	QUAD	Initialization & restart of four-body configuration.
STATUS	QUAD & NEWREG	Sorting of square distances & closest pair indices.
TRANS4	EREL4	Transformation to physical momenta.