

SCIUTILS

X-ray and Miscellaneous Scientific Computing Utilities
Version 0.9, updated 15 February 2014

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This manual is for SCIUTILS (version 0.9, 15 February 2014), which provides X-ray and miscellaneous scientific computing utilities

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1 Invocation

```
double genbeta(double a, double b);
double genbetai(double a, double b, double x);
double genbetaq(double a, double b, double x,
double betaab, double omxbxa, double psiofa);
```

The functions calculate extended generalized beta functions valid for negative a and b to the extent allowed by the integral definition

```
double ztoMpc(double h0, double oM, double oL, double z);
```

Calculates the transverse comoving distance, used in cosmology to relate redshift to metric distances. Divide by $1+z$ to get angular diameter distance. $h0$ is the hubble constant, oM is OmegaMatter, oL is OmegaLambda. The associated utility `angdist.c` uses this function, though it returns angular diameter distance by default.

```
double *double_readdata(char *rd_filename,
int rd_col, unsigned long *rd_count, int offset);
float *float_readdata(char *rd_filename, int rd_col,
unsigned long *rd_count, int offset);
long read_ascii(char *filenames, const char *fmt, char ***comments, ...);
```

These are functions to simplify reading ordered data from text files. The first two functions read column `rd_col` of a text file, storing the the number of rows in `rd_count`, and returning a newly created pointer to the 1D data, such that the first data element is in the `pointer[offset]`. Any elements before `pointer[offset]` are allocated but left undefined.

`read_ascii` acts like `fscanf`, and `fscanf`-like arguments such as “%f %d” go into the `*fmt`. `*filenames` may be comma-separated for reading multiple files. Comments lines within the files are assumed to begin with “#” and are stored in `***comments`. All the other arguments store the actual data, and are dynamically created.

```
char *sci_strdup(const char *s);
void grow_string_array(char ***ins, long nchar, char *string);
int parse_list(const char *inputlist, char delimit, char ***parsedlist);
int parse_list_double(const char *inputlist, char delimit, double **parsedlist);
```

Some string handling functions. The first allocates and duplicates a string argument, which may also be a constant. The second concatenates `string` to

```
int readarf(char *arfname, struct arf *result);
int readrmf(char *rmfname, struct rmf *result, struct ebounds *elimits);
int readpha(char *phaname, struct pha *result, int read_back);
int writepha(char *outname, struct pha *result);
void bin_pha(struct pha *spec, struct ebounds *elimits, double efit1,
double efit2, double syserrors);
```

```
float **readimage(char *fname, float *pixscale,
    unsigned long *nx, unsigned long *ny);
float **readimage_subset(char *fname, float *pixscale,
    unsigned long *nx, unsigned long *ny,
    long xcen, long ycen, float dist);
void writeimage(char *outfile, float **image, unsigned long nx,
    unsigned long ny, char *infile);

/* alloc.c */
double *sci_dvector(long nelem);
void sci_dvector_resize(double **dvec, long newsize);
float *sci_fvector(long nelem);
void sci_fvector_resize(float **dvec, long newsize);
int *sci_ivector(long nelem);
size_t *sci_sizetvector(long nelem);
float **sci_fmatrix(long nx, long ny);
double **sci_dmatrix(long nx, long ny);
int **sci_imatrix(long nx, long ny);
void sci_free_fmatrix(float **x);
void sci_free_dmatrix(double **x, long nx);
void sci_free_imatrix(int **x, long nx);
char **sci_stringmatrix(long nx, long slen);
void sci_free_stringmatrix(char **x, long nx);
double ***sci_dtensor(long nx, long ny, long nz);
void sci_free_dtensor(double ***x, long nx, long ny);
float ***sci_ftensor(long nx, long ny, long nz);
void sci_free_ftensor(float ***x, long nx, long ny);
char *sci_strcat(const char *s1, const char *s2);
```

2 Installation

In addition to a POSIX environment Hrothgar also requires the GNU Scientific Library (GSL), the compression library zlib, and the CFITSIO library to be installed.

For installation to /usr/local, installation proceeds via standard

```
./configure; make; sudo make install
```

Those without root access may install to another location via

```
./configure --prefix=/other/place; make; make install
```

3 Acknowledgments

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