The Early Years of Superstring Theory

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This quick survey of the (distant) past of string theory will mention some of the key developments. The choices are somewhat subjective.

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Bosonic string theory (1968-70): Veneziano, Fubini, Virasoro, Nambu, et al. Developed with the goal of constructing a theory of hadrons.

Free fermionic string (Jan 1971): P. Ramond.

A second bosonic string theory (Mar 1971): A. Neveu and JHS. These bosons and fermions combine to give a single theory. C. Thorn also contributed in showing this.

Supersymmetric world-sheet action (Aug 1971): J. Gervais and B. Sakita. First example of a supersymmetric action (as far as I know). This motivated Wess and Zumino to construct 4d susy theories a couple years later.

Yang–Mills at low energy (Aug 1971): A. Neveu and J. Scherk. Open strings with Chan–Paton factors.

Critical dimension (1971): C. Lovelace. Open-string closed-string duality. Before this we assumed $d = 4$.

No-ghost theorems (1972): R. Brower; P. Goddard and C. Thorn; JHS.

GR at low energy (1973): T. Yoneya. Closed strings.

Unification (1974): J. Scherk and JHS. Proposed using string theory to construct a theory of all forces. Strings shrank by 20 orders of magnitude. Optimistic about UV finiteness and beneficial extra dimensions.

N=4 super Yang–Mills (1976): L. Brink, J. Scherk, JHS.
Obtained by dimensional reduction of 10d SYM.

GSO projection (1977): F. Gliozzi, J. Scherk, D. Olive.
Evidence for 10d spacetime susy in string theory.

11d supergravity (1978): E. Cremmer, B. Julia, J. Scherk.

Supersymmetry breaking (1979): J. Scherk and JHS.
By twisted boundary conditions, etc.

Joël Scherk (1946–1980) passed away much too early. It was a great loss personally and for theoretical physics.

Collaboration with Michael Green

L. Brink participated in some of our work.

1980-82: Proved spacetime supersymmetry of the GSO projected theory. Formulated Type I, IIA, and IIB superstring theories. Computed various amplitudes.

1983: Constructed an alternative world-sheet action that makes 10d supersymmetry manifest.

1984: Analyzed gauge anomalies of type I superstring theories and discovered that only SO(32) is anomaly free. Showed that $E_8 \times E_8$ could also work, though we didn't know such a string theory. Gross et al. found it first.

After a ten-year period (1974–84) in which string theory for unification attracted very little interest, the subject suddenly took off.

Despite all the enthusiasm, there was also quite a bit of outspoken opposition to this subject. The main complaint was that it is far-removed from experiment. However, as many very bright young people entered the field, and amazing discoveries were made, string theory became mainstream. This conference is a testament to its vitality.