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CLASSIFICATION OF SIMPLE LIE ALGEBRAS OVER ALGEBRAICALLY CLOSED FIELDS OF PRIME CHARACTERISTIC

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We announce here a result which completes the classification of the finite-dimensional simple Lie algebras over an algebraically closed field F of characteristic $p > 7$, showing that these algebras are all of classical or Cartan type. This verifies the *Generalized Kostrikin-Šafarevič Conjecture* [Kos-70, Kac-74]. Many authors have contributed to the solution of this problem. For a discussion of work before 1986 see [Wil-87]. More recent work is cited in §1.

Let F be an algebraically closed field of characteristic $p > 7$ and L be a finite-dimensional semisimple Lie algebra over F. We identify L with $\operatorname{ad} L$, the subalgebra of inner derivations of L and write $\overline{L}$ for the restricted subalgebra of $\operatorname{Der} L$ (the algebra of derivations of L) generated by L. A *torus* T in $\overline{L}$ is a restricted subalgebra such that for every element $x \in T$, $\operatorname{ad} x$ is a semisimple linear transformation on L. Let $\mathcal{T}(L)$ denote the set of tori contained in $\overline{L}$. The (*absolute*) *toral rank* of L is

$$\operatorname{TR}(L) = \max\{\dim T | T \in \mathcal{T}(L)\}.$$

(The absolute toral rank may also be defined for nonsemisimple algebras [St-89a] using the theory of p-envelopes and this extension is necessary for the proofs of the results presented here.) We say a torus $T \subseteq \overline{L}$ is of *maximal rank* in $\overline{L}$ if $\dim T = \operatorname{TR}(L)$. If $T \in \mathcal{T}(L)$ we have the root space decomposition of L with respect to T,

$$L = \sum_{\alpha \in T^*} L_\alpha$$

where

$$L_\alpha = \{x \in L | [t, x] = \alpha(t)x \quad \text{for all } t \in T\}.$$

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